Global Finance Journal 45 (2020) 100478

Contents lists available at ScienceDirect

Global Finance Journal

journal homepage: www.elsevier.com/locate/gfj

The bank lending channel in the Malaysian Islamic and conventional banking system

Guglielmo Maria Caporale[a,*], Abdurrahman Nazif Çatık[b], Mohamad Husam Helmi[c], Faek Menla Ali[d], Mohammad Tajik[e]

[a] Brunel University London, UK
[b] Ege University, Turkey
[c] Durham Business School, University of Durham, UK
[d] University of Sussex Business School, University of Sussex, UK
[e] Brunel University London

ARTICLE INFO

JEL classification:
C32
E31
E42
E58

Keywords:
Bank lending channel
Malaysia
Monetary transmission
Islamic finance
Threshold VAR

ABSTRACT

This paper examines the bank lending channel of monetary transmission in Malaysia, a country with a dual banking system including both Islamic and conventional banks, over the period 1994: 01-2015:06. A two-regime threshold vector autoregression (TVAR) model is estimated to take into account possible nonlinearities in the relationship between bank lending and monetary policy under different economic conditions. The results indicate that Islamic credit is less responsive than conventional credit to interest rate shocks in both the high and low growth regimes; however, the sub-sample estimation shows that its response has increased in more recent years becoming quite similar to that of conventional credit. Moreover, the relative importance of Islamic credit shocks in driving output growth is notable in the low growth regime, their effects being positive. These findings can be interpreted in terms of the distinctive features of Islamic banks.

1. Introduction

The transmission mechanism of monetary policy has been analysed extensively in numerous studies focusing on countries with conventional banking systems (e.g., Bernanke & Gertler, 1995; Çatık & Martin, 2012; Pacicco, Vena, & Venegoni, 2019; among others). In addition, an increasing body of research has provided evidence of asymmetries or nonlinearities in the impact of monetary policy on macroeconomic variables such as the inflation rate and GDP growth (e.g., Caporale, Helmi, Çatık, Menla Ali, & Akdeniz, 2018 among others). Monetary policy appears to be different in economic expansion (growth) and contraction (recession) phases as its effectiveness over the phases of the business cycle might be different (Castro, 2011). For instance, Garcia and Schaller (2002) show that the response of central banks during contractions has a larger impact than during economic expansions.

However, there is very little evidence concerning economies with a dual (Islamic and conventional) banking system, where this mechanism might be rather different given the distinctive features of Islamic finance, such as the prohibition to charge a predetermined interest rate and the granting of credit only to productive projects (Chong & Liu, 2009): financing speculative activities is restricted since these are thought to cause an increase in the price level without contributing to the real economy, social justice and

* Corresponding author at: Department of Economics and Finance, Brunel University, London, UB8 3PH, UK.
E-mail addresses: Guglielmo-Maria.Caporale@brunel.ac.uk (G.M. Caporale), a.nazif.catik@ege.edu.tr (A.N. Çatık), mohamad.h.helmi@durham.ac.uk (M.H. Helmi), f.menla-ali@sussex.ac.uk (F. Menla Ali), tajik@ymail.com (M. Tajik).

https://doi.org/10.1016/j.gfj.2019.100478
Received 18 July 2018; Received in revised form 27 April 2019; Accepted 26 May 2019
Available online 03 June 2019
1044-0283/

economic efficiency, which Islamic finance should promote according to Sharia law[1] (Caporale & Helmi, 2018; Kammer et al., 2015). For instance, Kassim, Majid, and Yusof (2009) estimated a VAR model and reported instead that credit is more sensitive to interest rate movements in the case of Islamic banks in Malaysia, which might make them more unstable. Recently, Aysan, Disli, and Ozturk (2017) employed a panel-VAR model including deposits and credits for Islamic and conventional banks and confirmed the existence of a bank lending channel in Turkey, with both credit and deposits responding to changes in interest rates. However, monetary authorities might respond differently in economic expansion (growth) and contraction (recession) phases and, therefore, follow a nonlinear approach.

This paper contributes to the existing literature on Islamic finance by adopting a more suitable and sophisticated econometric framework to analyse monetary transmission in a country with a dual banking system (Islamic and conventional banks). Specifically, it applies for the first time in this context a nonlinear model to study the possibly asymmetric responses to shocks by policymakers in Malaysia: it estimates a Threshold VAR model (TVAR) with the output gap as the threshold variable. Most previous related studies on dual banking systems use only the conventional VAR approach and ignore the recent development in the macroeconomics literature suggesting asymmetric responses to shocks by policymakers (see, e.g., Sukmana & Kassim, 2010; Ergeç & Arslan, 2013; Aysan et al., 2017).[2] Further, empirical studies on Malaysia have not explored yet whether the reaction of both Islamic and conventional banks differs during economic expansion (growth) and contraction (recession) phases, even though Khalid, Ahmad, and Hamidi (2018) more recently confirmed that using the Markov Switching Vector Autoregression model nonlinear framework is more appropriate for the Taylor rule in Malaysia. Therefore, the present study aims to fill this gap by allowing for nonlinearities in the bank lending channel in the case of Malaysia.[3]

More specifically, it analyses the role of both Islamic and conventional credit during the different phases of the business cycle. Our TVAR model has several interesting features that make it particularly suitable for analysing the impact of monetary policy on bank lending behaviour in the case of Malaysia. First, it allows for potential nonlinearities in the responses to monetary policy shocks, which is crucial since the impact of the latter may depend upon the macroeconomic conditions. Second, since the threshold variable is treated as an endogenous variable, regime switches resulting from structural shocks can also be captured (Atanasova, 2003; Balke, 2000): the impulse response functions in a TVAR model depend on the size and sign of shocks as well as the state of the economy.

Our results show that Islamic credit is less responsive than conventional credit to interest rate shocks in both high and low growth regimes in Malaysia. However, the sub-sample estimation suggests that it has increased in recent years becoming quite similar to that of conventional credit. Moreover, the relative importance of Islamic credit shocks in driving output growth is notable in the low growth regime, their effects being positive.

The paper is organised as follows: Section 2 reviews Islamic finance and the different role of Islamic and conventional banks in the bank lending channel of monetary policy; Section 3 describes the data and provides a preliminary analysis; Section 4 outlines the methodology; Section 5 discusses the empirical results; finally, Section 6 offers some concluding remarks.

2. Islamic finance and the monetary policy transmission channels

2.1. Islamic finance

Although Islamic banks share some features with conventional financial intermediaries, they differ from the latter in that they operate on the basis of the Sharia principles outlined in the Quran, the hadith[4] and Islamic jurisprudence, with the ex-post PLS rate replacing the predetermined rate of commercial banks (Chong & Liu, 2009). The prohibition of the conventional ex-ante interest rate is seen as instrumental to improving both social justice and economic efficiency (Berg & Kim, 2014). That is, Islamic banking is a case of ethical finance and hence it has economic implications for systemic stability and the distribution of credit risk, since the productivity of the project, rather than the creditworthiness of borrowers (as in the case of conventional banks) is the main factor determining the allocation of credit (see Di Mauro et al., 2013).

Another important feature of Islamic banks is that they are not allowed to engage in any speculative transactions such as derivatives, toxic assets and gambling, which are not compliant with Sharia principles (Beck, Demirgüç-Kunt, & Merrouche, 2013). It is reckoned that financing such activities is responsible for many financial crises and normally causes an increase in the price level rather than contributing to real activities in the economy (Di Mauro et al., 2013). Speculative investments make conventional banks "risk transferring" while Islamic banks are "risk sharing" (see Hasan & Dridi, 2010). Further, Islamic banks only provide credit to finance productive investment rather than speculative activities (Kammer et al., 2015). Each financial transaction is underpinned by

[1] Sharia law is based on the Quran, the hadith and Islamic jurisprudence developed by many Muslim scholars.

[2] Çatık and Martin (2012) extended the work of Çatık and Karaçuka (2012) by using a TVAR model to analyse different monetary transmission mechanisms; however, they did not consider the possible role of Islamic finance. They found that the response to macroeconomic shocks has become different in Turkey compared to other market economies following the introduction of inflation targeting.

[3] This country has one of the largest Islamic banking sectors in the world, accounting for around 16.7% of the Islamic finance global market in 2014 (Ernst and Young, 2014). Further, it has had well-established Islamic financial institutions for over 30 years, with the share of Islamic finance growing from 0.073% in 1994 to 27.846% in 2016 at a compounded annual growth rate of 38.3% compared to 7.9% for conventional banks. Islamic banks are expected to grow at a yearly rate of 18% for the next five years, with the Malaysian authorities planning to increase their market share to 40% of total financing by 2020 and aiming to make the country an international hub for Islamic finance (BNM, 2012).

[4] Hadith represents the actions and sayings of the prophet Mohammad, which are one of the main sources of Islamic guidance in many aspects of Muslim life including economic activities.

Table 1
Market share and number of Islamic banks by country.

Country	Market share of Islamic banks %			% changes	No of Islamic banks
	2007	2012	2015	2007–2015	
Indonesia	0.621%	4.623%	5%	3.982%	6
Turkey	2.960%	5.134%	5.432%	2.643%	5
Iran	100%	100%	100%	0.00%	16
Sudan	100%	100%	100%	0.00%	34
Singapore	0.212%	0.061%	N/A	N/A	5
Jordan	6.203%	13%	14.900%	8.745%	4
Tunisia	1.514%	2.203%	4.991%	0.691%	3
Malaysia	7.263%	21.351%	26.362	19.103%	18
Kuwait	32.136%	37.721%	45.234%	13.114%	5
Saudi Arabia	37%	53%	53.721%	16.736%	4
UAE	15%	17%	23.534%	8.543%	8
Bahrain	6.734%	26.924%	29.353%	22.612%	7
Qatar	13%	24%	29%	16%	4
Pakistan	3.824%	5.753%	11.404%	7.632%	5
Average	23.320%	29.341%	235.292%	9.221%	

Sources: BankScope, Central Banks of different countries, Ernst and Young (2014, 2016) and author's calculation. The countries in the table represent > 93% of international Islamic banking assets (Ernst and Young, 2016).

an existing or potential real asset, whilst conventional banks can provide credit without such constraints (Askari, 2012). In addition, Islamic banks cannot generate profit based on pure financing so they must engage, for instance, in investment or sale transactions and share both the return and the risk of the contract (Baele, Farooq, & Ongena, 2014).

2.2. Evolution of Islamic banks in Malaysia and other countries

The assets and market share of Islamic banks have grown considerably over the last decade. In 2016, more than $2.6 trillion were invested in Sharia-compliant assets and this figure is expected to reach $3 trillion in 2018. Table 1 shows the assets of Islamic banks in selected countries over a period of eight years. It is apparent that their shares are different across countries, varying from 100% in both Iran and Sudan to < 1% in Singapore. However, there has been a significant increase in the market share of Islamic banks in all countries; for instance, in Pakistan, it rose from 3.8% in 2007 to 11.4% in 2015 and it more than doubled in Jordan from 6.20% in 2007 to 14.9% in 2015. The average increase in the market share of Islamic banks is 12.5% in the 14 countries considered (see Table 1).[5]

Fig. 1 shows that Islamic banking in the GCC has a market share of 25%–50% highlighting its importance in providing funds to the local economy. Islamic banks in Saudi Arabia have the highest market share (53.7%) in the region, followed by Kuwait (45.2%). In Bahrain, the United Arab Emirates and Qatar this sector represents 23–29% of total banking assets.

Of particular interest is the case of Malaysia, where bank credit represents 70% of total finance. Further, it has had well-established Islamic financial institutions for over 34 years (BNM, 2015). The Islamic bank Act (IBA) was introduced in 1983, and the first Islamic bank started its operation in the same year. Conventional banks were allowed to open an Islamic finance window in March 1993. There was a sharp increase in the market share of Islamic banks in Malaysia from < 1% in 1994 to around 26.36% in 2015 with a compounded annual growth rate of 38.3% compared to 7.9% for conventional banks (see Fig. 2). Bank Negara Malaysia (BNM) aims to increase the market share of Islamic banks to 40% of total financing by 2020 in order to make Malaysia an international hub for Islamic finance (BNM, 2012).

2.3. Monetary policy transmission channels

It is essential for policymakers to examine how the effects of monetary policy shocks are transmitted to the real economy. For instance, a contractionary policy leads to an increase in real interest rates, which causes a decline in investment spending, aggregate demand and GDP growth. Monetary policy can also affect the value of equities (e.g. stocks and real estate) through an increase in interest rates resulting in a decline in both consumption and investment expenditure.

The traditional monetary policy channels have been examined in many empirical studies, with mixed results (see Bernanke & Gertler, 1995; Çatık & Martin, 2012; Pacicco et al., 2019 among others). Some authors (Mishkin, 1995a, 1995b) have argued that the effects on the real economy are related not only to asset prices, interest rate and cost of capital but also to frictions in financial intermediation. Therefore, credit should be considered as an important channel for policy transmission. Next we discuss the essential

[5] These countries represent > 93% of international Islamic banking assets (Ernst and Young, 2016).

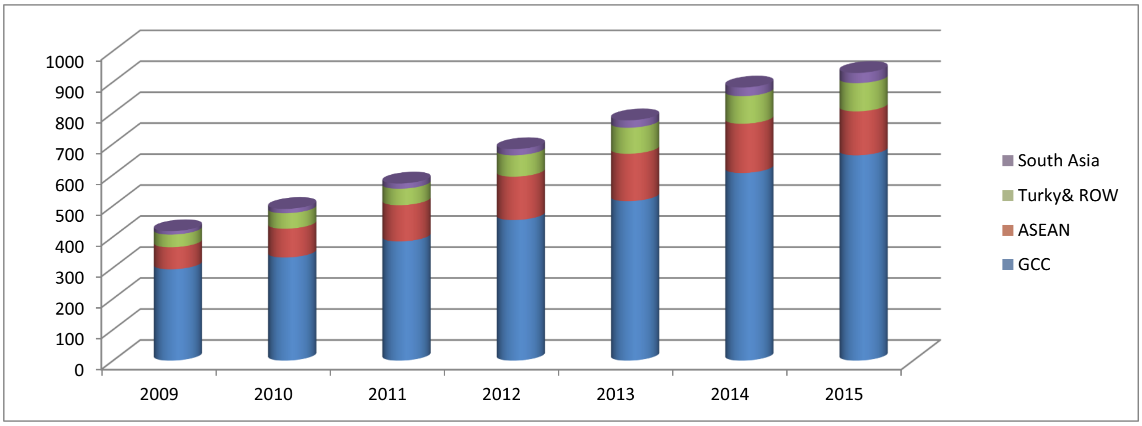

Fig. 1. Islamic banking assets in different countries (US$b)
Sources: Central banks and Ernst and Young (2016) analysis.
GCC includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE, ASEAN (Malaysia, Indonesia), South Asıa (Pakistan, Bangladesh) and Turkey and rest of the world (Egypt, Jordan, Turkey, South Africa, Sudan, etc.).

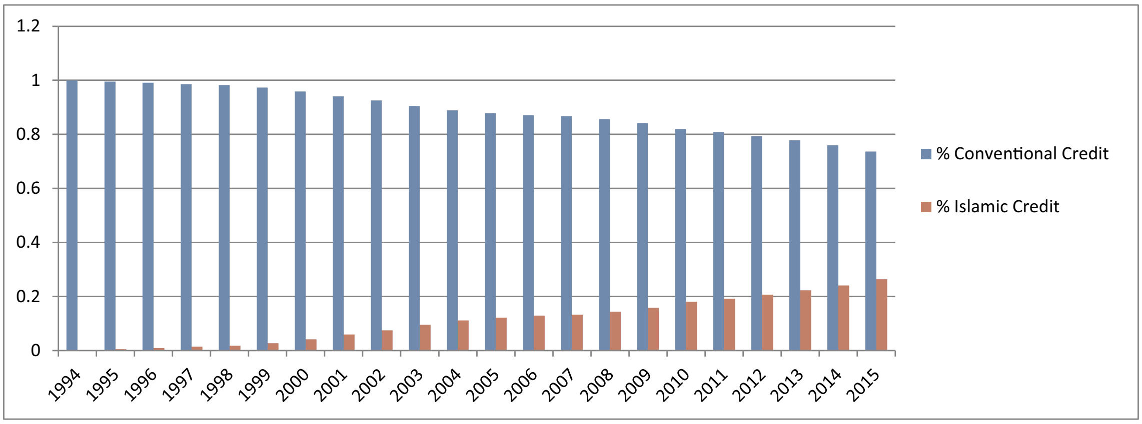

Fig. 2. % Credit of Conventional and Islamic banks in Malaysia.
Sources: the Bank Negara Malaysia (BNM).

role of the bank lending channel in Malaysia, where most economic activities are funded through loans from both Islamic and conventional banks.

2.3.1. The bank lending channel

The bank lending channel (also called narrow credit) shows how the effects of changes in monetary policy rates are transmitted to the economy through the supply of credit facilities by banks. Medium- and small-sized firms fund their activities mainly through banks, while large corporations have access to bank credit as well as non-banking sources of credit through the financial markets (see Kashyap & Stein, 1995 among others). If the supply of banks credit to the private sectors is decreased, the external finance premium increases, which causes a decline in output. For instance, contractionary monetary policy, draining bank reserves and deposits, will decrease the supply of loanable funds. This decreases households' and firms' spending, and reduces real economic activities (Mishkin, 2001).

Further, medium and small-sized companies are more affected by monetary policy actions than large companies with easy access to other financial securities, such as bonds and equities. For instance, when there is an increase in interest rates, large companies are more likely to raise capital from the financial market, while the medium and small-sized companies still have to heavily depend on bank loans to finance their operational activities (see Boivin, Kiley, & Mishkin, 2010). Although this channel is very important in all

Table 2
Islamic finance and market share (in billions of Malaysian ringgit).

Year	Conventional Credit	Islamic Credit	Total credit	Conventional Credit %	Islamic credit %
1994	2,146,053.900	1564.000	2,147,617.900	99.927	0.072
1995	2,659,210.100	12,657.000	2,671,867.100	99.526	0.473
1996	3,413,804.606	31,625.436	3,445,430.042	99.082	0.917
1997	4,539,882.779	64,185.838	4,604,068.617	98.605	1.394
1998	4,951,279.604	87,805.270	5,039,084.874	98.257	1.742
1999	4,696,946.848	129,926.909	4,826,873.757	97.308	2.691
2000	4,637,357.715	200,841.440	4,838,199.155	95.848	4.151
2001	4,809,882.934	301,883.581	5,111,766.515	94.094	5.905
2002	4,934,721.500	399,125.000	5,333,846.500	92.517	7.482
2003	5,043,652.034	527,895.366	5,571,547.400	90.525	9.474
2004	5,248,558.788	656,889.322	5,905,448.110	88.876	11.123
2005	5,641,546.106	779,947.811	6,421,493.917	87.854	12.145
2006	6,050,310.020	897,672.204	6,947,982.224	87.080	12.919
2007	6,488,891.667	993,340.068	7,482,231.735	86.724	13.275
2008	7,089,582.727	1,188,055.700	8,277,638.427	85.647	14.352
2009	7,580,680.146	1,426,741.613	9,007,421.756	84.160	15.839
2010	8,223,356.607	1,807,254.525	10,030,611.131	81.982	18.017
2011	9,188,292.524	2,170,136.477	11,358,428.994	80.894	19.105
2012	10,089,211.262	2,631,159.15	12,720,370.41	79.315	20.684
2013	10,884,900.881	3,111,621.68	13,996,522.56	77.768	22.231
2014	11,642,664.494	3,690,233.49	15,332,897.98	75.932	24.067
2015	12,310,145.803	4,407,404.81	16,717,550.61	73.636	26.363
2016	12,745,099.682	4,918,818.62	17,663,918.31	72.153	27.846

Sources: The Central Bank of Malaysia and authors' calculations.

economies, it is expected to play an even more significant role in transmitting monetary policy shocks to the real economy in developing countries and emerging markets (Mishkin, 1995b), since these economies are either bank-based or have less developed financial markets, which are less liquid compared to those of the developed countries.

The discussion above highlights the role of conventional banks in the transmission mechanism of the monetary policy, especially in the developing and emerging economies. Recently, the growing role of Islamic finance in some countries has come to the attention of researchers. The share of Islamic banks has increased in Malaysia from < 1% in 1994 to 27.84% in 2016 with a compounded annual growth rate of 38.3% compared to 7.9% for conventional banks (see Table 2). Given this very sizeable growth, it is important to investigate how monetary policy is transmitted through the banking channel in a dual banking system (Islamic and conventional banking) such as the Malaysian one, which is the objective of this study.

2.3.2. Islamic vs. conventional banks and monetary policy

Investigating the effectiveness of monetary policy in a dual banking system is a challenging task. It requires identifying the role of Islamic banks in the transmission mechanism of monetary policy as they have a different business model. Further, the importance of Islamic banks for the bank lending channel is still being debated (Ibrahim & Alam, 2017). They play the same role as conventional ones as financial intermediates but are different from the point of view of the interest rates charged and their business model. For, example, Islamic banks are not allowed to charge pre-determined interest rate on loans or offer a fixed rate on deposits, that is, they operate according to the Sharia principles. Their role depends on several factors such as their market share and the structure of Islamic contracts. In addition, Islamic financial instruments, such as money and interbank markets, are either underdeveloped or have not been established in some countries with Islamic banks such as Syria.

Ibrahim and Alam (2017) argue that the restriction on providing funds to some prohibited business activities (e.g., producing Alcohol, weapons, etc.) might affect the contribution of Islamic credit to the economy compared to commercial credit. However, Islamic banks provide a significant percentage of their funds to small and medium enterprises (SMEs), which usually have limited access to credit through conventional banks and this might increase the financial inclusion of SMEs.[6] For instance, Kim, Yu, and Hassan (2018) show that financial inclusion strengthens financial deepening and has positive impact on economic growth in the Organization of Islamic Cooperation (OIC) countries.

In a dual banking system, the lack of market-based instruments and the underdevelopment of the Islamic money market have restricted the liquidity facilities for these banks and limited their access to various tools for liquidity management, which forces them to hold more liquidity and has an impact on their profitability (Di Mauro et al., 2013; Ibrahim & Alam, 2017). In addition, Islamic banks are considered to be less cost effective and over capitalized, which makes them less competitive in a dual banking system (Beck et al., 2013). The behaviour of customers in response to changes in the interest rate depends on the characteristics of clients. Religion–motivated customers with religious constraints are less likely to switch their deposits to conventional banks if the rate of return on deposits in Islamic banks becomes lower than

[6] Financial inclusion aims to offer fair opportunity and remove the barriers of certain segments of the society (e.g., poor farmers, SMEs, and rural enterprises) to access affordable financial products and services with a low-cost (Chakravarty & Pal, 2013).

their conventional counterparts (Baele et al., 2014). By contrast, profit-motivated customers characterized by economic rationality might switch their deposits to conventional banks to exploit such an arbitrage opportunity (Aysan, Disli, Duygun, & Ozturk, 2018). Further, the spillovers from the conventional banks to their Islamic counterparts expose them to a form of risk called displaced commercial risk (DCR), since increases in the interest rate charged by conventional banks may cause a withdrawal of deposits from Islamic banks (Baldwin, Alhalboni, & Helmi, 2018; Daher, Masih, & Ibrahim, 2015).

For the reasons discussed above, the bank lending channel is expected to work differently for Islamic vis-a-vis conventional banks. This is confirmed by the few existing studies on Malaysia and other countries (e.g., Aysan et al., 2017; Kassim et al., 2009 among others). As in the case of other emerging markets, in Malaysia financial markets are dominated by bank credit, which represents 70% of total finance (BNM, 2015). Further, the PLS paradigm might increase the access to finance for medium and small -sized enterprises, which are classified as the main borrowers of Islamic banks in Malaysia and elsewhere (Iqbal & Mirakhor, 2013). Moreover, Islamic banks provide credit to households and private sectors not normally dealing with banks for religious reasons, which results in higher financial inclusion (see Baele et al., 2014).

Only a few studies have examined monetary policy transmission mechanism in countries with both conventional and Islamic banks (see Aysan et al., 2017; Ergeç & Arslan, 2013; Kassim et al., 2009 and Sukmana & Kassim, 2010). For instance, Khan and Mirakhor (1989) argued that Islamic banks are less affected by monetary shocks (and therefore are more stable) than conventional banks, the reason being that profit and loss sharing allows Islamic banks to transfer part of the risk to the depositors (Ghassan, Fachin, & Guendouz, 2013). Kassim et al. (2009) reported instead that credit is more sensitive to interest rate movements in the case of Islamic banks in Malaysia, which might make them more unstable using a vector autoregression (VAR) model. These results were confirmed by Akhatova, Zainal, and Ibrahim (2016) who estimate a SVAR, examining the reaction of both Islamic and conventional banks to monetary policy shocks in Malaysia. They find a significant response by Islamic banks to a positive interest rate shock. Similary, Sukmana and Kassim (2010) used a VAR framework and found significant evidence that Islamic banks in Malaysia contribute to the transmission of monetary policy shocks to the real economy through the banking channel; they argued that policymakers should address the issues specific to Islamic banks when designing and implementing monetary policy.

Ergeç and Arslan (2013) used a vector error correction model (VECM) and found that movements in the overnight interest rate have asymmetric effects on Islamic and conventional banks in Turkey: for instance, a positive interest rate shock leads to an increase (decrease) in the level of deposits in conventional (Islamic) banks. Aysan et al. (2017) used a panel-VAR and found that Islamic bank credit is more responsive to interest rate shocks. Their findings can be explained by various reasons such as the compositional differences in credit portfolios between both banks and the tendency of Islamic banks toward SME credits. More specifically, they stressed that since SMEs are more sensitive to monetary and economic shocks, the loan demand for SME credits would also be more sensitive to monetary and economic shocks. However, Khatat (2016) argued that the lower responsiveness of Islamic credit to monetary policy shocks could be related to the behaviour of depositors and borrowers when reacting to interest rate movements and the level of development in the Islamic money markets. More recently, Hamza and Saadaoui (2018) examined the monetary transmission mechanism through Islamic banks' debt financing channel using the system GMM estimator for a sample composed of 50 Islamic banks in 10 countries for the period 2005–2014. Their results showed that the financing level by Islamic banks decreases in response to a monetary tightening and confirmed the presence of a debt financing channel of monetary policy.

None of the studies mentioned above examines the monetary transmission mechanism in countries with a dual banking system (including both Islamic and conventional banks) allowing for possible nonlinearities, thereby ignoring the recent development in the macroeconomics literature suggesting asymmetric responses to shocks by policymakers. Given the special features of Islamic finance and the unique dual banking system in Malaysia, one would expect a different response to a monetary policy shock from Islamic compared to conventional banks. Allowing for nonlinearities enables the researcher to distinguish between the dynamic response of the two types of banks during contractions and expansions respectively.

3. Data description and preliminary analysis

To investigate the bank lending channel of monetary policy in the dual banking system of Malaysia, we collected monthly data for Islamic credit and conventional credit from the National Bank of Malaysia. In addition, data on the money supply (M2), the consumer price index (CPI), the industrial production index (IPI), and the overnight policy rate (I) were retrieved from the IMF's International Financial Statistics (IFS). The resulting sample includes 258 monthly observations over the period 1994:01-2015:06.[7]

In order to examine the time series properties of the variables under consideration, a battery of unit root tests was carried out. In addition to the conventional augmented Dickey-Fuller (ADF) and Phillips and Perron (1988) tests, we also performed the Lee and Strazicich (2003) one allowing for two structural breaks to take into account the possible impact of the global and local crises on the degree of integration of the series.[8] The results of the Lee and Strazicich (2003) tests, reported in Table 3, confirm those of the ADF and PP tests, although several significant breakpoints are identified.[9] Hence, all variables can be treated as I(1), and can be entered

[7] The start date of our sample is set according to the availability of Islamic credit data from the National Bank of Malaysia.

[8] These test results of the ADF and the Phillips-Perron (1988) are not reported but are available upon request.

[9] The unit root with breaks test results indicate the statistical significance of several breakpoints for most variables including those related to the Asian financial crisis and the global financial crisis; however, they are sensitive to whether or not we allow for changes in the intercept only or both the intercept and trend. In general, there is no specific pattern which can be identified across variables in terms of the breakpoints corresponding to economic events occurring during the investigation period (see Table 3).

Table 3
Lee and Strazicich unit root tests with two structural breaks.

	Model A (Crash Model)			Model C (Trend Shift Model)				
	Statistics	Breaks		Statistics	Breaks			
		D_{1t}	D_{2t}		D_{1t}	D_{2t}	DT_{1t}	DT_{2t}
int_t	−3.204	1998:01	2011:04	−5.846*	1997:06	2000:07	1997:06	2000:07
		(5.793)	(0.351)		(9.101)	(0.385)	(−5.971)	(5.699)
Δint_t	−11.748***	1998:4	2005:10	−10.927***	1996:10	1999:07	1996:10	1999:07
		(−0.537)	(0.251)		(1.064)	(0.033)	(−1.079)	(4.254)
$lccre_t$	−3.170	1998:12	2008:04	−2.780	1997:07	2003:03	1997:07	2003:03
		(1.047)	(0.201)		(2.921)	(−0.198)	(−10.121)	(4.463)
$\Delta lccre_t$	−2.697	1999:11	2008:10	−6.155**	1997:04	2007:07	1997:04	2007:07
		(−1.872)	(−2.403)		(2.912)	(−2.313)	(−5.462)	(5.732)
$lcpi_t$	−1.865	2006:03	2008:10	−4.087	1999:11	2006:02	1999:11	2006:02
		(−1.736)	(−2.298)		(3.009)	(4.362)	(−4.586)	(3.202)
$\Delta lcpi_t$	−5.612***	1999:05	2009:02	−9.206***	2008:05	2010:05	2008:05	2010:05
		(−0.750)	(−0.607)		(13.381)	(−1.424)	(−9.327)	(9.364)
$lner_t$	−1.886	1998:08	2007:09	−5.222	1998:03	2010:06	1998:03	2010:06
		(−4.336)	(−1.201)		(−3.369)	(0.488)	(3.808)	(−3.736)
$\Delta lner_t$	−4.404**	1997:09	1998:01	−5.441*	1997:08	1998:10	1997:08	1998:10
		(−4.596)	(−7.314)		(−0.454)	(−3.041)	(−5.122)	(5.483)
$licre_t$	0.275	1997:04	1999:04	−2.918	1997:11	2002:05	1997:11	2002:05
		(4.538)	(1.627)		(1.230)	(0.390)	(−6.646)	(0.533)
$\Delta licre_t$	−5.510***	1998:02	2003:08	−7.787***	1997:04	1999:12	1997:04	1999:12
		(−1.850)	(−0.761)		(8.146)	(−1.216)	(−6.648)	(6.491)
lip_t	−1.454	2006:09	2008:09	−4.127	1998:03	2008:08	1998:03	2008:08
		(−0.209)	(−0.351)		(−1.593)	(−5.123)	(−2.413)	(−5.242)
Δlip_t	−5.375***	2002:06	2010:02	−6.502***	1997:12	2000:11	1997:12	2000:11
		(1.113)	(1.748)		(−10.152)	(1.677)	(5.780)	(−6.384)
$lm2_t$	−2.684	1998:03	2003:11	−4.060	2000:12	2006:04	2000:12	2006:04
		(−1.377)	(−2.484)		(−0.117)	(−0.899)	(−3.819)	(2.845)
$\Delta lm2_t$	−5.166***	2002:12	2010:04	−8.004***	1997:11	2005:06	1997:11	2005:06
		(0.649)	(0.356)		(4.908)	(−5.428)	(−7.389)	(7.781)
$ltcre_t$	−3.200	1999:04	2008:06	−2.914	1998:10	2011:07	1998:10	2011:07
		(2.734)	(−0.668)		(0.975)	(0.351)	(−7.742)	(3.472)
$\Delta ltcre_t$	−6.542***	1998:01	2007:12	−12.843***	1997:11	2000:03	1997:11	2000:03
		(−3.201)	(−3.063)		(−0.358)	(0.388)	(−7.924)	(4.163)
ffr_t	−2.817	2001:04	2008:01	4.256	2002:06	2007:12	2002:06	2007:12
		(−2.494)	(−6.035)		(−0.005)	(0.206)	(−2.138)	(−5.352)
Δffr_t	−5.421***	1999:05	2007:04	−8.810***	2005:08	2008:09	2005:08	2008:09
		(−1.189)	(−0.800)		(−6.726)	(8.330)	(8.106)	(−8.267)
$lcompri_t$	−1.828	2010:04	2012:08	−4.268	2001:12	2010:04	2001:12	2010:04
		(−3.586)	(1.566)		(0.391)	(−4.137)	(1.188)	(−0.660)
$\Delta lcompri_t$	−4.621***	2002:08	2013:05	−6.855***	2006:04	2009:06	2006:04	2009:06
		(1.3770)	(−0.484)		(2.807)	(−2.213)	(−4.357)	(6.469)
$lipus_t$	−1.446	2005:08	2008:08	−4.428	1998:06	2008:08	1998:06	2008:08
		(−3.728)	(−7.293)		(−1.203)	(−6.661)	(−0.310)	(−3.206)
$\Delta lipus_t$	−5.509***	1999:05	2007:02	−8.568***	2005:08	2008:09	2005:08	2008:09
		(1.348)	(−0.681)		(−6.384)	(7.986)	(7.844)	(−8.017)

Notes: Δ is the first difference operator. $ltcre_t$, $lccre_t$, $licre_t$, int_t, $lcpi_t$, $lipi_t$, $lm2_t$, $lcompri_t$, ffr_t, $lipus_t$, and $lner_t$ denote respectively the log of total credit, the log of conventional credit, the log of Islamic credit, policy rate, the log of price level, the log of industrial production, the log of money supply, the log of the world commodity price index, the US federal funds rate, the log of the US industrial production index, and the log of the nominal exchange rate vis-à-vis the US dollar. The general to specific procedure is followed to find the optimum lag length, allowing for a maximum of 12 lags. The t-statistics are represented in parentheses (.). The critical values are obtained from Lee and Strazicich (2003). Model A allows for breaks in the intercept, whereas Model C allows for breaks in both the intercept and the trend. D_{1t} and D_{2t} refer to the first and second break dates, while DT_{1t} and DT_{2t} indicate the first and second break dates when allowing for the trend. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Summary of descriptive statistics for the endogenous variables.

	$\Delta ltcre_t$	$\Delta lccre_t$	$\Delta licre_t$	Δint_t	$\Delta lcpi_t$	$\Delta lipi_t$	$\Delta lm2_t$
Maximum	0.059	0.058	0.692	4.260	0.038	0.096	0.055
Minimum	−0.019	−0.020	−0.024	−5.180	−0.011	−0.076	−0.019
Mean	0.008	0.006	0.034	−0.001	0.002	0.004	0.009
St. Deviation	0.008	0.009	0.069	0.590	0.003	0.026	0.010
Skewness	0.964	0.994	5.584	−1.581	3.205	0.203	0.556
Ex. kurtosis	7.322	7.145	42.658	40.598	32.750	3.722	4.503
JB	238.951 ***	225.567 ***	18,107.124***	15,185.521***	9923.702 ***	7.357 **	37.301 ***
Observations	256	256	256	256	256	256	256

Notes: $\Delta ltcre_t$, $\Delta lccre_t$, $\Delta licre_t$, Δint_t, $\Delta lcpi_t$, $\Delta lipi_t$, and $\Delta lm2_t$ denote respectively total credit changes, conventional credit changes, Islamic credit changes, policy rate changes, price level changes (inflation), industrial production growth, and money supply growth, respectively. JB is the Jarque-Bera test for normality. ***, and ** indicate statistical significance at the 1% and 5% levels, respectively.

into the VAR/TVAR models in first differences.

A wide range of descriptive statistics are reported in Table 4. The means of monthly total, conventional, and Islamic credit changes are all positive. The highest is that of Islamic credit changes, which highlights its sharp growth relative to conventional credit over the sample period. All other means are also positive, except that of policy rate changes, which is negative and small. Islamic credit changes are more volatile than both total and conventional credit changes, and both interest rate changes and industrial production growth are more volatile than inflation and money growth. Most variables exhibit skewness (positive in all cases, with the exception of policy rate changes) and excess kurtosis. The Jarque-Bera (JB) test statistics imply a rejection at the 5% level of the null hypothesis of normality.

4. The model

The VAR approach is the most frequently used in the literature investigating the monetary transmission mechanism. Its advantage is that it does not require imposing possibly arbitrary exclusion restrictions, an issue even more relevant in the case of emerging countries whose economic structure is less well known (Mishra, Montiel, & Spilimbergo, 2012). Further, it estimates the dynamic response of the system to a shock without debatable identification restrictions (Sims, 1980). Following Bernanke and Blinder (1992), linear VAR models are often estimated. However, since monetary policy is designed differently during economic expansion (growth) and contraction (recession) phases, a nonlinear specification is more appropriate. Therefore, we investigate the bank lending channel in Malaysia by estimating a TVAR model, which is an extension of the linear VAR model in which the economy has two regimes and switches between them depending on the optimum value of the threshold variable. A two-regime TVAR model is specified as follows (Atanasova, 2003; Balke, 2000):

$$Y_t = I\left[c_{t-d} \geq \gamma\right]\left(A_0^1 + \sum_{i=1}^{p} B_t^1 Y_{t-i} + \sum_{i=1}^{q} C_t^1 X_{t-i}\right) + I\left[c_{t-d} < \gamma\right]\left(A_0^2 + \sum_{i=1}^{p} B_t^2 Y_{t-i} + \sum_{i=1}^{q} C_t^2 X_{t-i}\right) + \varepsilon_t, \tag{1}$$

where Y_t and X_t stand for the vectors of endogenous and exogenous variables respectively, A_0 is the vector of intercept terms, B_t and C_t are parameter matrices, p and q are the lag orders of the endogenous and exogenous variables respectively, and ε_t is the vector of innovations with a variance covariance matrix of $E(\varepsilon_t \varepsilon_t') = \Sigma$. Given that we use three alternative measures for credit (in logs), namely total credit ($ltcre_t$), Islamic credit ($licre_t$), and commercial or conventional credit ($lccre_t$), three different vectors of endogenous variables are used as follows:

$$\text{Model 1: } Y_{1,t}' = [\Delta lm2_t, \Delta int_t, \Delta ltcre_t, \Delta lcpi_t, \Delta lipi_t], \tag{2}$$

$$\text{Model 2: } Y_{2,t}' = [\Delta lm2_t, \Delta int_t, \Delta lccre_t, \Delta lcpi_t, \Delta lipi_t], \tag{3}$$

$$\text{Model 3: } Y_{3,t}' = [\Delta lm2_t, \Delta int_t, \Delta licre_t, \Delta lcpi_t, \Delta lipi_t], \tag{4}$$

where Δ is the first difference operator, int_t stands for the interbank rate, $lm2_t$ denotes the log of money supply M2, $lcpi_t$ is the log of the CPI. Since GDP data are not available on a monthly basis, the log of the industrial production index, denoted by $lipi_t$, is used as a proxy for economic activity. Although the use of the money supply as a monetary policy instrument is disputed in the literature, we have decided to include this variable in order to capture some information about liquidity in the economy (Lucas, 2014). McCauley (2006) documents that the Central Bank of Malaysia drains reserves out of the banking system in the face of chronic excess liquidity

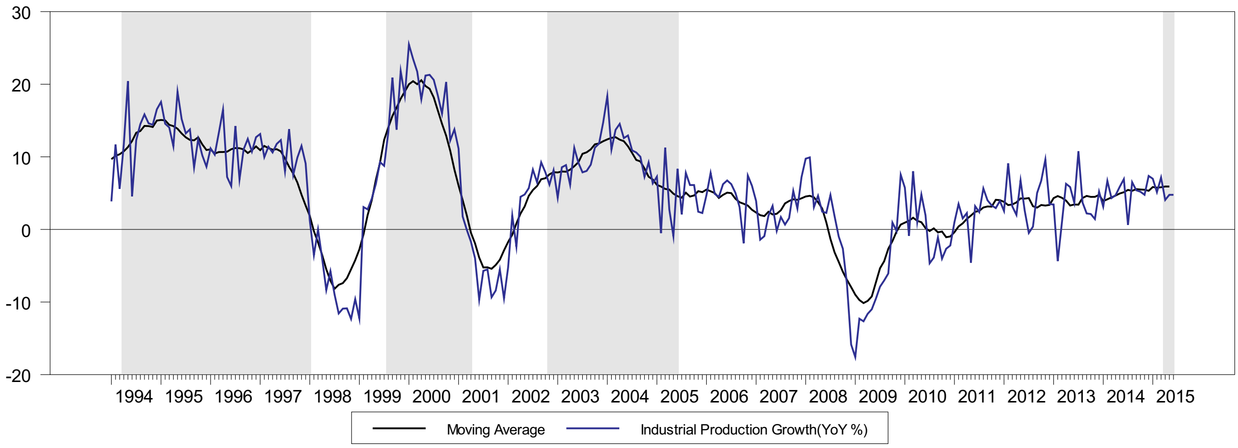

Fig. 3. Regime classifications
Note: Upper regime where $\gamma \geq 5.5615$, is represented by the shaded areas obtained from the TVAR, specification of model 1.

or to keep short-term interest rates at their target level. For instance, it promoted the repo market by announcing in February 2005 that it would introduce several measures to enhance liquidity and make domestic financial markets (especially the ringgit bond market) more efficient.[10]

In order to capture the possible effects of global developments on the conduct of monetary policy, the following exogenous variables are included when each of the above vectors of the endogenous variables are estimated (Peersman & Smets, 2003):

$$X_t' = [\Delta lcompri_t, \Delta ffr_t, \Delta lipius_t, \Delta lner_t], \tag{5}$$

where $lcompri_t$ is the log of the world commodity price index (included to take into account the "price puzzle" as in Gordon and Leeper (1994)), ffr_t is the US federal funds rate, $lipius_t$ is the log of the US industrial production index, and, $lner_t$ is the log of the domestic nominal exchange rate vis-à-vis the US dollar.

Further, c is the threshold variable and γ is the optimum value of the threshold; $I[.]$ is the dummy indicator function that equals 1 when $c_{t-d} \geq \gamma$, and 0 otherwise. c_{t-d} is the threshold variable lagged by d periods. The threshold variable is often defined as the moving average of one of the endogenous variables in Y_t (see for example Balke, 2000). In our case, it is the twenty-four month moving average of the IPI growth rate, $magr_{t-d}$ (see Fig. 3).[11]

Eq. (1) indicates that the economy is in regime 1 when the threshold variable exceeds or is equal to the optimal threshold value, i.e., $c_{t-d} \geq \gamma$, otherwise it is in regime 2. If there is no significant difference between the estimated parameters across the two regimes, i.e., $A_0^1 = A_0^2$, $B_i^1 = B_i^2$, $C_i^1 = C_i^2$, the threshold model reduces to a linear VAR one.

The regime switching parameter$(A_i^1, A_i^2, B_i^1, B_i^2, C_i^1, and\ C_i^2)$s , the threshold value (γ) and the delay parameter (d) can all be estimated endogenously within this framework. First, the optimum number of lags of the endogenous and exogenous variables is determined on the basis of model selection criteria. Then, the existence of a threshold effect in a multivariate framework is tested using the $C(d)$ statistic introduced by Tsay (1998), which is a multivariate extension of Tsay's (1989) nonlinearity test. The procedure is the following: the variables are ordered according to increasing values of the threshold variable, $magr_t$, then the VAR model is estimated recursively starting from the first m_0 observations; finally, the test statistic is calculated by regressing the residuals on the explanatory variables, and testing for the joint significance of the latter. If the model is linear, the residuals should be uncorrelated with the explanatory variables; under the null of linearity, i.e., $H_0: A_0^1 = A_0^2$, $B_i^1 = B_i^2$, $C_i^1 = C_i^2$, the test statistic follows a chi-squared distribution with $k(pk + qv + 1)$ degrees of freedom, k and v being the number of variables in the vectors of endogenous and exogenous variables respectively, and p and q the corresponding lag orders.

After the determination of the delay parameter, the $C(d)$ statistic is computed over the trimmed interval of the threshold parameter, $(c_1\ and\ c_2) = [0.15, 0.85]$, to maximise the probability of identifying the two regimes. Then, this interval is partitioned into

[10] These measures include the active use of repurchase agreements (repo) as a monetary policy instrument, the introduction of the Institutional Securities Custodian Programme (ISCAP) to enable the borrowing and lending of securities, and a securities lending facility for principal dealers (BNM, 2006).

[11] Following Balke (2000), we also consider a moving average of credit growth as another potential threshold variable. The results of the non-linearity tests carried out indicate that the existence of a significant threshold effect is rejected when the total credit change is used as the threshold variable. Therefore, a moving average of IPI growth rate is used instead for the TVAR estimates. An alternative threshold variable is obtained applying the Hodrick-Prescott filter to the IPI. The C(d) test results yield very similar regime classifications and qualitatively similar impulse responses and variance decompositions. These additional results are not reported in the paper but are available upon request.

Table 5
Multivariate threshold nonlinearity tests.

Model 1				Model 2				Model 3			
d	m_0	*C(d)* statistics	*P*-value	*d*	m_0	*C(d) statistics*	P-value	*d*	m_0	*C(d) statistics*	P-value
1	25	186.490	0.000	1	25	188.160	0.000	1	25	164.240	0.000
1	50	174.990	0.000	1	50	176.150	0.000	1	50	157.070	0.000
2	25	172.430	0.000	2	25	174.790	0.000	2	25	154.080	0.000
2	50	188.660	0.000	2	50	190.040	0.000	2	50	168.210	0.000
3	25	173.450	0.000	3	25	177.260	0.000	3	25	174.110	0.000
3	50	188.780	0.000	3	50	194.410	0.000	3	50	184.250	0.000
4	25	121.780	0.033	4	25	125.550	0.020	4	25	106.660	0.195
4	50	120.120	0.042	4	50	123.730	0.025	4	50	105.140	0.224
5	25	136.840	0.003	5	25	142.250	0.001	5	25	117.300	0.060
5	50	131.730	0.008	5	50	137.170	0.003	5	50	113.370	0.096
γ	5.561	AIC	2440.741	γ	5.558	AIC	2427.456	γ	*5.556*	AIC	3312.632

Notes: The AIC refers to the minimum value of Akaike Information Criterion, *C(d)* statistics is based on the arrangedregression model introduced by Tsay (1998), *d* is the delay parameter, m_0 refers to the number of initial observations, and γ represents the optimum values of the threshold variable, *magr* (the twenty-four month moving average of the IPI growth rate).

grids, and the model is estimated for each grid. The grid, including the minimum selection criteria value, is selected as the optimal threshold value of the transition variable, γ. The impulse response functions and forecast error decompositions obtained from this model are nonlinear since the parameters are allowed to evolve over regimes.

5. Empirical results

5.1. Threshold value estimation

A pre-requisite to the estimation of the TVAR models is the computation of *C(d)* statistics to uncover the presence of a threshold effect in a multivariate framework. The results from the recursive estimation based on the starting points of $m_0 = 25$ and $m_0 = 50$ and the delay parameters of $d = 1, 2, 3, 4$ and 5 are presented in Table 5. Except the fourth and fifth lags of model 3, the null hypothesis of linearity is rejected at the 5% significance level. This implies that there are two different regimes corresponding to different phases of the business cycle. The optimum delay parameter of the threshold variable, $magr_{t-d}$, is estimated to be equal to 3 for all three TVAR specifications on the basis of the χ^2 test statistic. Then, the interval containing the possible optimal threshold value of the $magr_{t-d}$ [−0.709 12.025] is partitioned into 500 grids, and the optimal threshold value for each TVAR model is obtained in the grid satisfying the minimum Akaike Information Criterion (AIC). The estimated threshold values of 5.561%, 5.558% and 5.556% for models 1, 2, and 3, respectively, lead to very similar regime classifications. It is also noteworthy that the endogenously estimated optimal threshold values are slightly above the average growth rate of industrial production (5.294%) over the investigation period. On that basis, regimes 1 and 2 can be defined as the upper and lower growth regimes respectively, since they contain observations above or below the optimal threshold.

Having identified the regimes, generalized impulse response functions are estimated (see Figs. 4 to 9) and forecast error variance decomposition analysis (see Tables 6 and 7) is conducted for the three TVAR models (see Eqs. (2), (3) and (4)). The results from a simple linear VAR model are also presented for comparison purposes.

5.2. Responses of GDP growth and inflation to monetary policy shocks

Figs. 4 and 5 show the estimated responses of output growth and inflation respectively to a positive interest rate and negative money supply shock (a tightening of monetary policy), computed from the TVAR (model 1) and the corresponding simple linear VAR model.

In the case of the linear VAR (see Fig. 4) the effect of the interest rate shock on output growth is what one would anticipate: a rise in the policy rate decreases output growth, which bottoms out about two months after the shock occurs. However, the TVAR estimation suggests that the response of output growth to the interest rate shock is regime dependent, being greater in the low than in the high growth regime (see Fig. 5). This finding is in line with those of Peersman and Smets (2002), Garcia and Schaller (2002), and Avdjiev and Zeng (2014), who also reported that monetary policy shocks have a stronger impact on GDP growth when the economy is in the low economic growth regime. Regarding the response of inflation to the interest rate shock (Fig. 4), the initial positive response is relatively small in the high growth regime, and then becomes negative before weakening and dying out in the following months. By

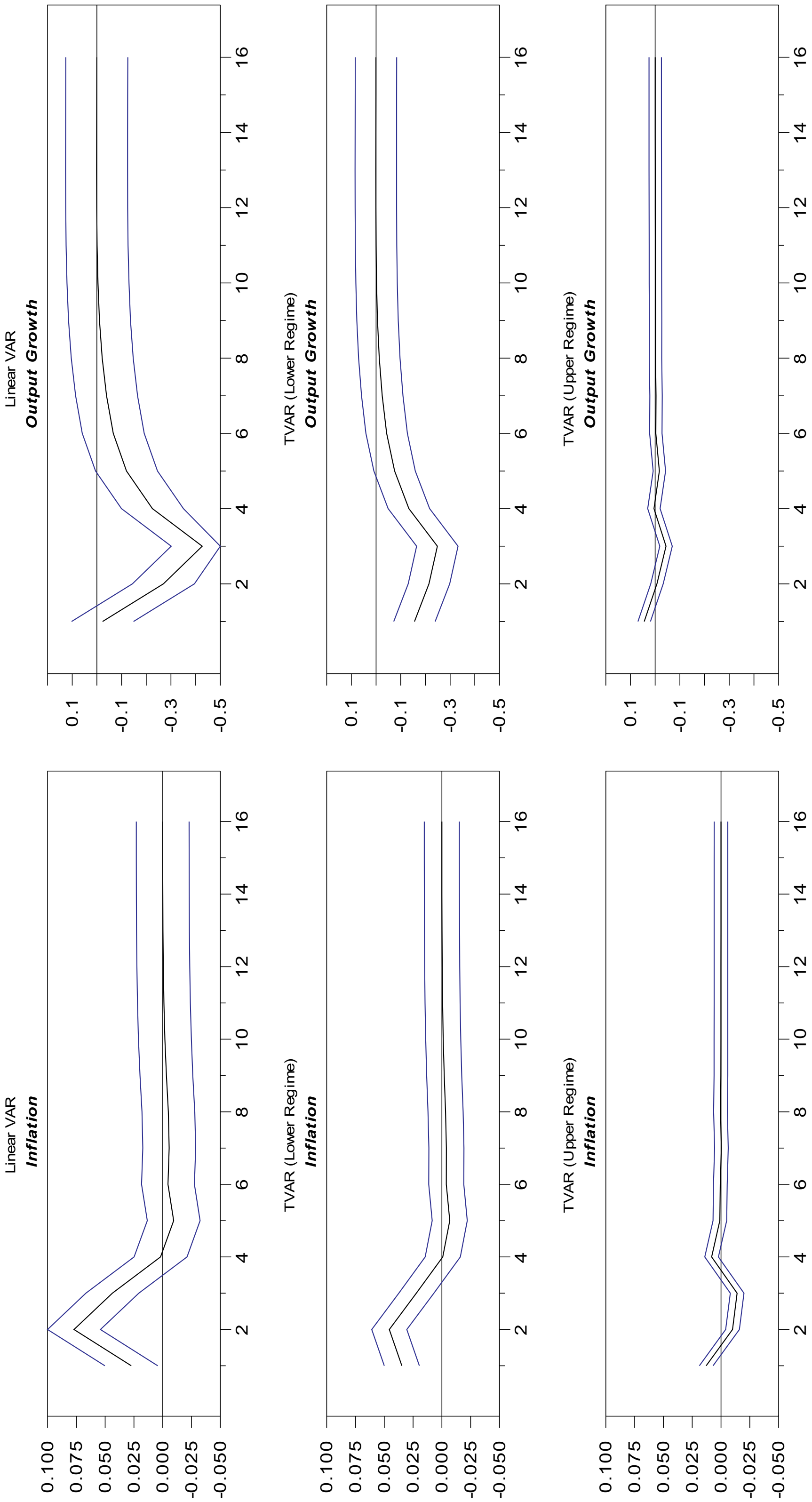

Fig. 4. Responses to interest rate shocks
Note: The figures are obtained from model 1.

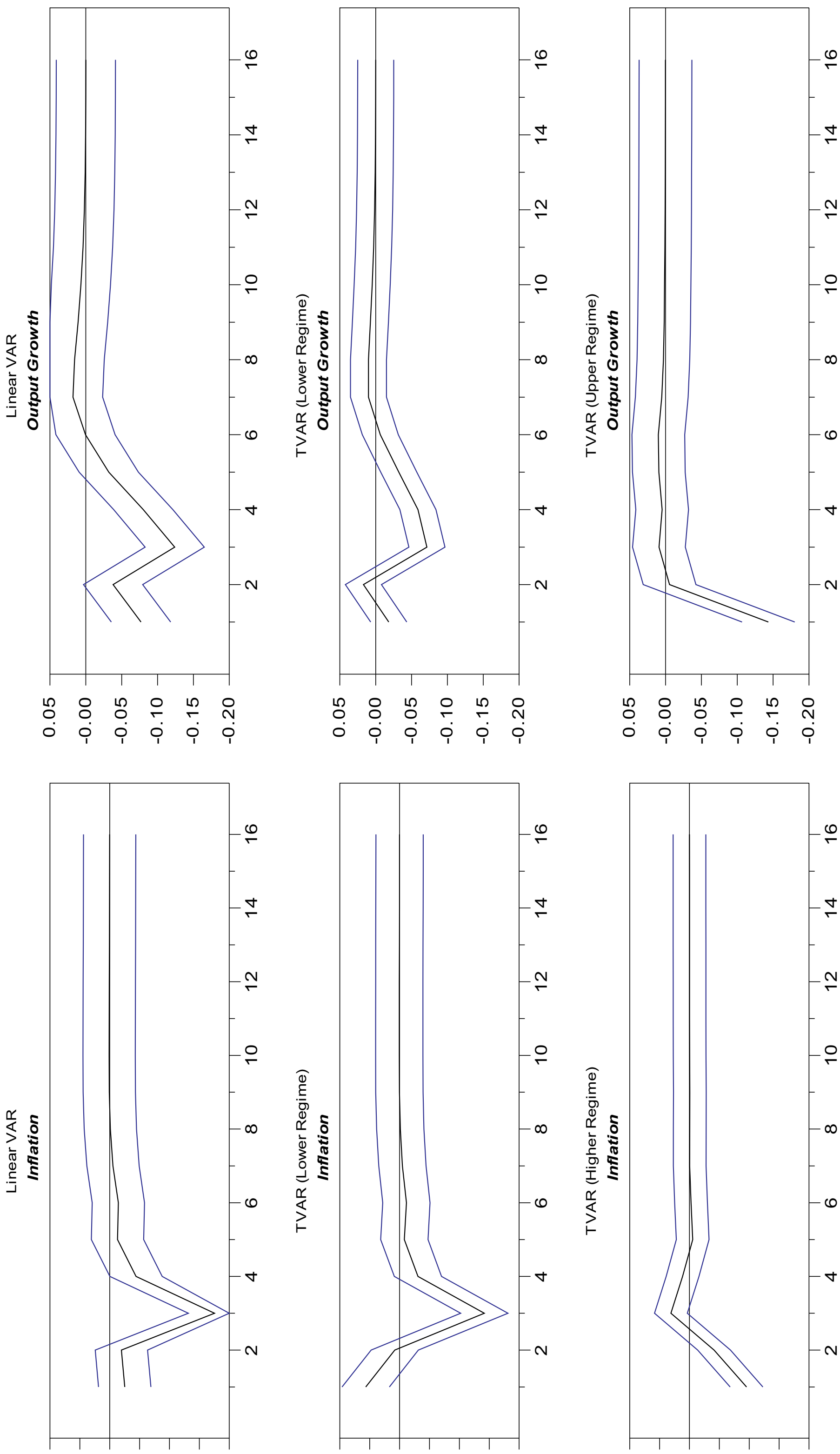

Fig. 5. Responses to negative money supply shocks
Note: The figures are obtained from model 1.

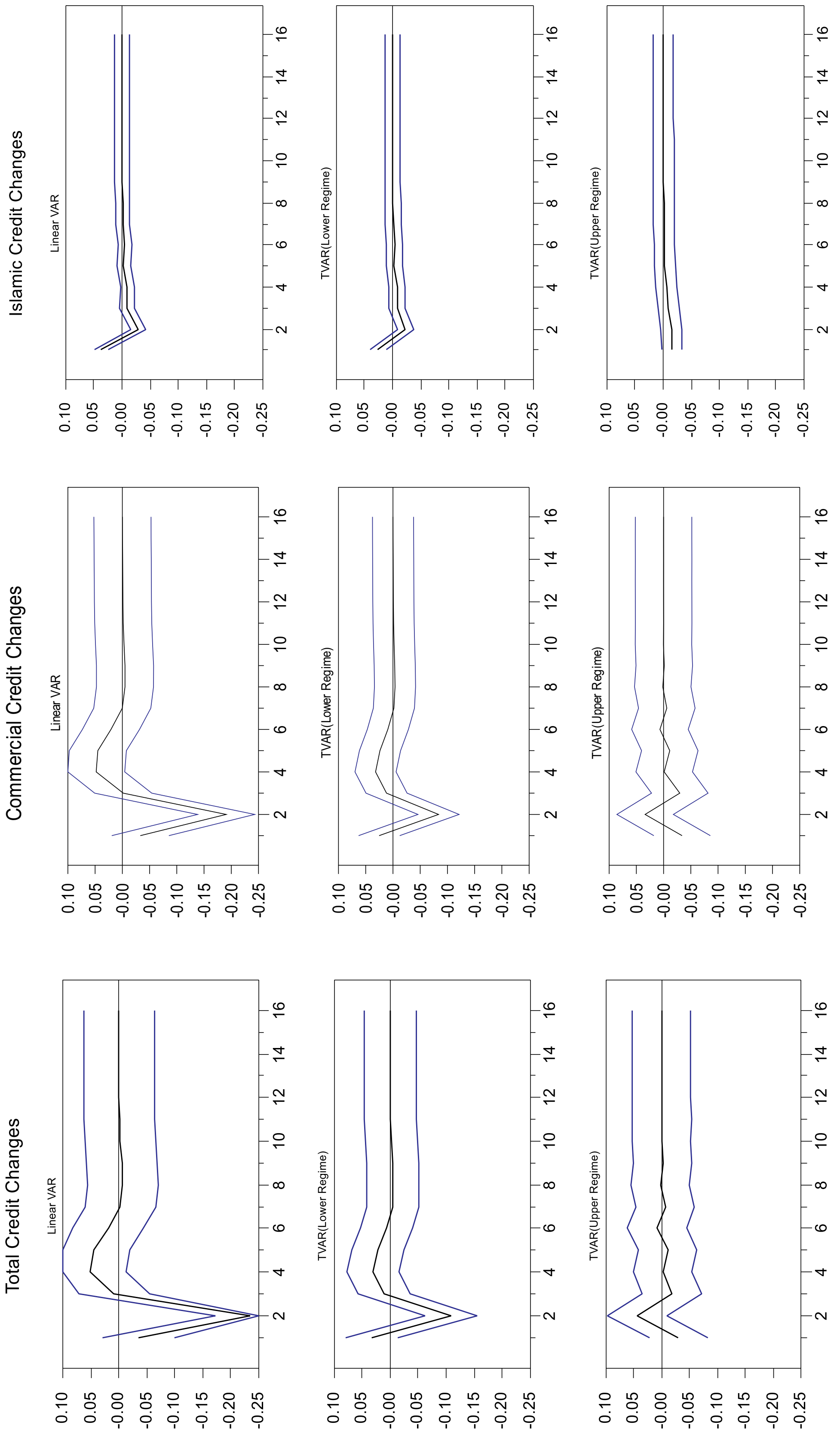

Fig. 6. Responses of credit changes to interest rate shocks.

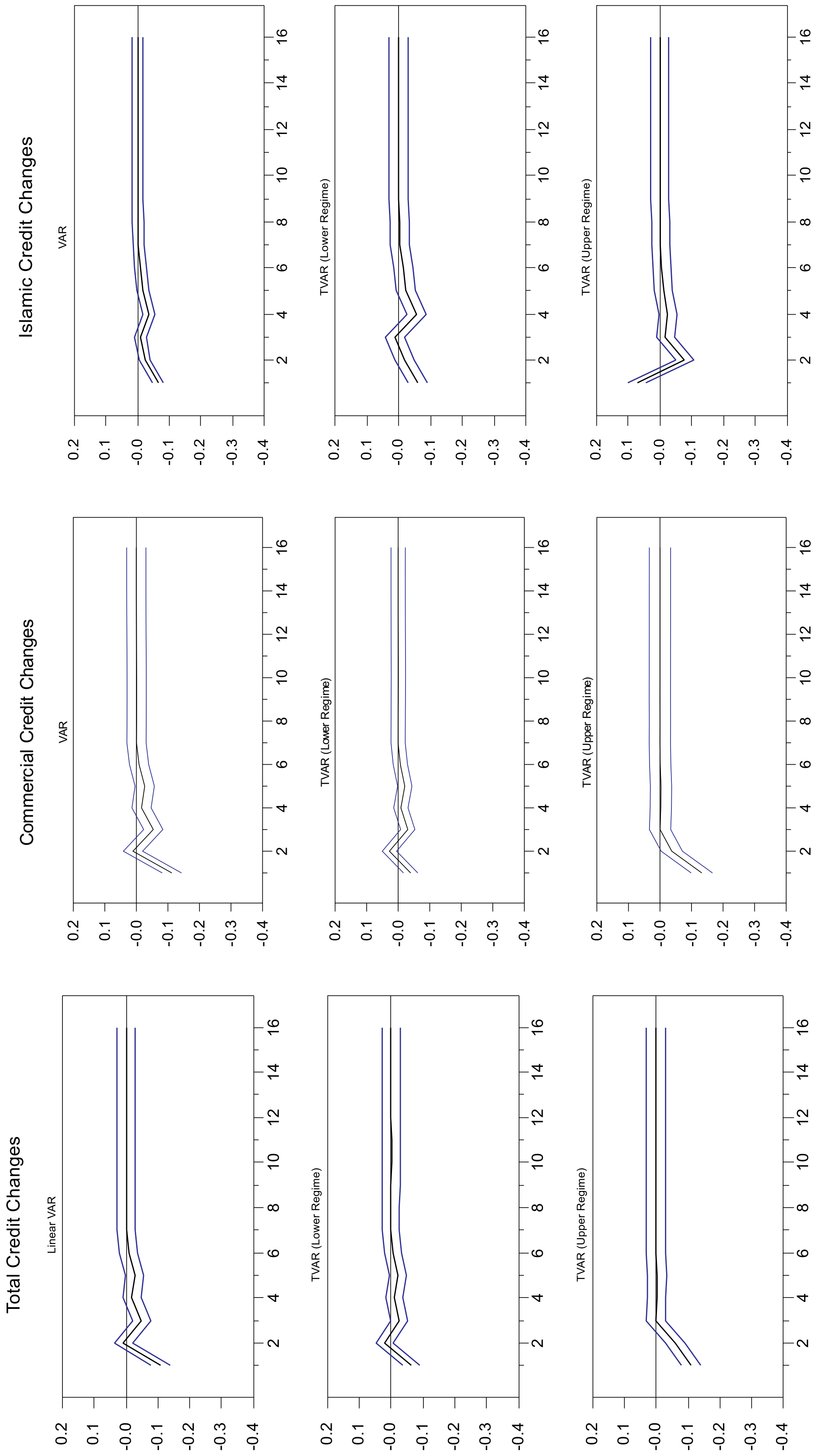

Fig. 7. Responses of credit changes to negative money supply shocks.

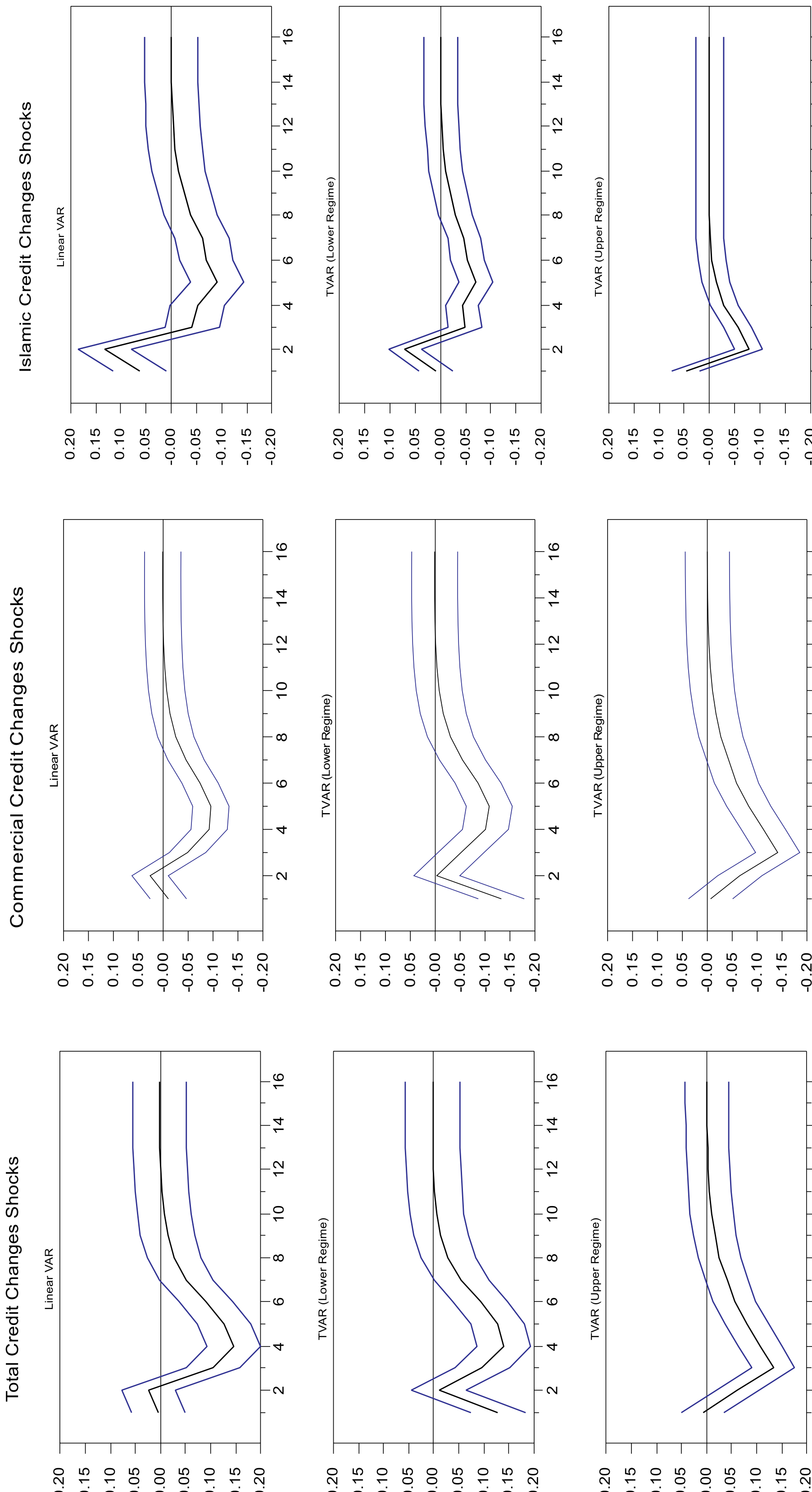

Fig. 8. Responses of output growth to negative credit shocks.

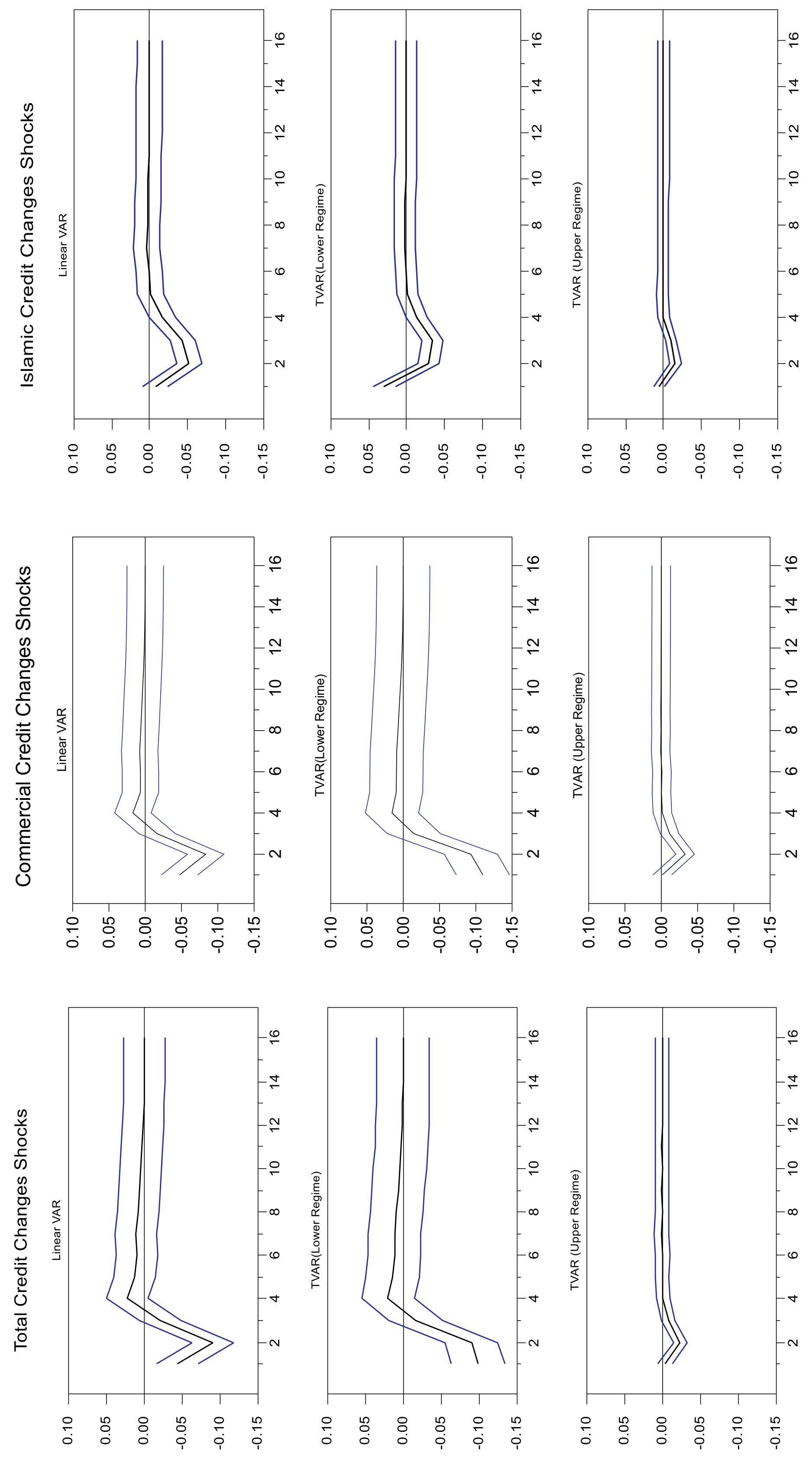

Fig. 9. Responses of inflation to negative credit shocks.

Table 6
Variance decomposition of inflation.

Model 1

Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta ltcre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
Linear VAR						
1	0.342	0.134	0.639	1.553	97.675	0.000
3	0.357	0.865	0.909	2.466	95.724	0.036
6	0.358	0.984	0.924	2.554	95.309	0.230
9	0.358	0.985	0.926	2.554	95.305	0.231
12	0.358	0.985	0.926	2.554	95.305	0.231
15	0.358	0.985	0.926	2.554	95.305	0.231
Upper Regime						
1	0.277	3.219	0.299	0.876	95.606	0.000
3	0.285	3.812	0.678	1.064	93.452	0.994
6	0.286	3.840	0.757	1.173	92.709	1.521
9	0.287	3.838	0.757	1.196	92.669	1.541
12	0.287	3.838	0.757	1.198	92.666	1.542
15	0.287	3.838	0.757	1.198	92.665	1.542
Lower Regime						
1	0.364	0.643	0.667	4.268	94.422	0.000
3	0.393	2.797	1.821	8.107	86.308	0.967
6	0.394	2.911	1.896	8.239	85.879	1.075
9	0.394	2.914	1.906	8.250	85.853	1.077
12	0.394	2.914	1.907	8.251	85.852	1.077
15	0.394	2.914	1.907	8.251	85.852	1.077

Model 2

Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta lccre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
Linear VAR						
1	0.341	0.116	0.638	1.936	97.310	0.000
3	0.357	0.845	0.928	3.362	94.837	0.029
6	0.358	0.970	0.941	3.425	94.462	0.203
9	0.358	0.971	0.943	3.425	94.458	0.204
12	0.358	0.971	0.943	3.425	94.458	0.204
15	0.358	0.971	0.943	3.425	94.458	0.204
Upper Regime						
1	0.276	2.824	0.321	1.324	95.531	0.000
3	0.285	3.441	0.681	2.228	92.642	1.007
6	0.286	3.468	0.745	2.330	91.960	1.498
9	0.286	3.466	0.744	2.354	91.917	1.517
12	0.286	3.466	0.744	2.356	91.914	1.519
15	0.286	3.466	0.744	2.356	91.914	1.519
Lower Regime						
1	0.363	0.715	0.732	4.741	93.811	0.000
3	0.392	2.781	2.018	8.263	85.992	0.945
6	0.394	2.908	2.078	8.395	85.598	1.022
9	0.394	2.910	2.090	8.400	85.577	1.023
12	0.394	2.910	2.091	8.400	85.576	1.023
15	0.394	2.910	2.091	8.400	85.576	1.023

Model 3

Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta licre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
Linear VAR						
1	0.346	0.179	0.885	0.006	98.930	0.000
3	0.362	1.647	1.234	0.967	96.002	0.149
6	0.363	1.790	1.251	0.964	95.554	0.442
9	0.363	1.790	1.255	0.964	95.545	0.446
12	0.363	1.790	1.255	0.964	95.545	0.446
15	0.363	1.790	1.255	0.964	95.545	0.446
Upper Regime						
1	0.220	7.640	0.024	1.781	90.556	0.000
3	0.224	7.604	0.400	2.731	89.201	0.065
6	0.225	7.591	0.546	2.751	88.851	0.260
9	0.225	7.590	0.552	2.753	88.837	0.269
12	0.225	7.590	0.552	2.753	88.836	0.270
15	0.225	7.590	0.552	2.753	88.836	0.270
Lower Regime						
1	0.413	1.589	1.041	0.919	96.451	0.000
3	0.446	3.746	2.713	1.534	91.003	1.003
6	0.449	3.860	2.857	1.666	89.992	1.625
9	0.449	3.855	2.898	1.770	89.843	1.634
12	0.449	3.854	2.900	1.792	89.816	1.639
15	0.449	3.853	2.901	1.792	89.814	1.639

Notes: Models 1, 2 and 3 are respectively based on the vectors $Y_{1,t}' = [\Delta lm2_t, \Delta int_t, \Delta ltcre_t, \Delta lcpi_t, \Delta lipi_t]$, $Y_{2,t}' = [\Delta lm2_t, \Delta int_t, \Delta lccre_t, \Delta lcpi_t, \Delta lipi_t]$ and $Y_{3,t}' = [\Delta lm2_t, \Delta int_t, \Delta licre_t, \Delta lcpi_t, \Delta lipi_t]$, respectively.

Table 7
Variance decomposition of output.

Step	Model 1						Mode 2							Mode 3						
	Linear VAR						*Linear VAR*							*Linear VAR*						
	S.E.	$\Delta lm2_t$	Δint_t	$\Delta ltcre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta lccre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta licre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
1	0.750	1.053	0.092	0.020	0.062	98.773	1	0.750	0.980	0.128	0.153	0.076	98.662	1	0.791	0.794	0.227	1.687	0.013	97.278
3	0.960	0.782	3.357	0.326	0.232	95.302	3	0.962	0.741	3.653	0.242	0.280	95.084	3	1.007	0.766	4.372	1.708	0.464	92.690
6	0.973	0.787	3.671	1.024	0.621	93.897	6	0.974	0.751	4.029	0.641	0.658	93.921	6	1.026	0.746	4.966	1.681	1.221	91.386
9	0.973	0.791	3.670	1.071	0.643	93.824	9	0.974	0.754	4.029	0.677	0.675	93.865	9	1.027	0.753	4.983	1.686	1.255	91.323
12	0.973	0.792	3.670	1.072	0.643	93.823	12	0.974	0.754	4.029	0.677	0.675	93.865	12	1.027	0.753	4.983	1.686	1.255	91.323
15	0.973	0.792	3.670	1.072	0.643	93.823	15	0.974	0.754	4.029	0.677	0.675	93.865	15	1.027	0.753	4.983	1.686	1.255	91.323
Step	*Upper Regime*						*Upper Regime*							*Upper Regime*						
	S.E.	$\Delta lm2_t$	Δint_t	$\Delta ltcre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta lccre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta licre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
1	0.583	6.911	0.890	0.356	0.011	91.832	1	0.584	6.853	1.144	0.178	0.004	91.821	1	0.596	2.683	0.268	0.144	0.594	96.311
3	0.719	4.650	0.865	3.873	1.603	89.009	3	0.719	4.678	0.952	3.907	1.409	89.054	3	0.740	3.299	1.204	2.258	2.713	90.525
6	0.750	4.299	0.853	7.265	1.851	85.732	6	0.751	4.328	0.935	7.549	1.637	85.551	6	0.774	3.271	1.380	3.483	3.465	88.401
9	0.753	4.269	0.848	7.582	1.902	85.399	9	0.754	4.295	0.928	7.921	1.679	85.177	9	0.777	3.280	1.402	3.592	3.536	88.190
12	0.753	4.267	0.847	7.603	1.906	85.377	12	0.754	4.293	0.927	7.947	1.682	85.151	12	0.777	3.281	1.403	3.598	3.540	88.178
15	0.753	4.267	0.847	7.605	1.906	85.375	15	0.754	4.293	0.927	7.949	1.683	85.149	15	0.777	3.281	1.403	3.598	3.541	88.177
Step	*Lower Regime*						*Lower Regime*							*Lower Regime*						
	S.E.	$\Delta lm2_t$	Δint_t	$\Delta ltcre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta lccre_t$	$\Delta lcpi_t$	$\Delta lipi_t$	Step	S.E.	$\Delta lm2_t$	Δint_t	$\Delta licre_t$	$\Delta lcpi_t$	$\Delta lipi_t$
1	0.776	0.050	3.869	5.056	2.971	88.053	1	0.776	0.077	3.998	5.531	3.058	87.336	1	0.791	0.055	4.080	1.012	1.875	92.978
3	0.982	0.379	14.057	4.026	8.231	73.308	3	0.982	0.425	14.733	4.262	7.674	72.906	3	0.998	0.354	10.458	5.003	7.432	76.752
6	1.006	0.624	16.300	4.653	8.373	70.050	6	1.007	0.677	17.477	4.459	7.857	69.530	6	1.048	0.692	10.407	11.260	7.543	70.097
9	1.008	0.637	16.282	4.854	8.474	69.753	9	1.009	0.689	17.470	4.629	7.965	69.247	9	1.056	0.690	10.390	12.204	7.551	69.165
12	1.008	0.640	16.281	4.855	8.476	69.748	12	1.009	0.692	17.469	4.631	7.967	69.242	12	1.057	0.691	10.438	12.202	7.554	69.116
15	1.008	0.640	16.281	4.855	8.476	69.748	15	1.009	0.692	17.469	4.631	7.967	69.242	15	1.057	0.691	10.437	12.209	7.556	69.107

Notes: Models 1, 2 and 3 are respectively based on the vectors $Y_{1,\ t}^{'} = [\Delta lm2_t, \Delta int_t, \Delta ltcre_t, \Delta lcpi_t\ \Delta lipi_t]$, $Y_{2,\ t}^{'} = [\Delta lm2_t, \Delta int_t, \Delta lccre_t, \Delta lcpi_t\ \Delta lipi_t]$ and $Y_{3,\ t}^{'} = [\Delta lm2_t, \Delta int_t, \Delta licre_t, \Delta lcpi_t\ \Delta lipi_t]$, respectively.

contrast, in the low growth regime (and in the linear VAR) the initial positive response is larger and increases further during the first month, after which it decreases until it dies out. The qualitative results are rather similar when commodity prices are replaced with the oil price as an exogenous variable to mitigate the issue of the "price puzzle" (see Fig. A1 in the Appendix A). Therefore, they confirm its existence[12] in the lower growth regime and are consistent with those of Hanson (2004), who estimated a structural vector autoregressive (SVAR) model and found that most indicators (e.g., commodity prices and oil price) used to mitigate the "price puzzle" cannot resolve it over certain sample periods.

Concerning the effects of a negative money supply shock (Fig. 5), visual inspection suggests that the dynamic impact of such a shock on GDP growth is also not the same across the two regimes. For instance, the initial impact in the high growth regime is significantly negative and it takes one month for such an effect to die out. By contrast, in the low growth regime the impact becomes notable in the second month, when it leads to a significant decline in GDP growth, after which it dies out over the following months. With respect to the response of inflation, the initial impact of a negative money supply shock is negative (positive) in the high (low) growth regime. It is noteworthy that the negative impact in the high regime weakens over the first two months, whereas the positive effect in the low regime becomes negative in the second month, after which it dies out over the following months.[13]

5.3. Responses of credit variables to monetary policy shocks

Fig. 6 displays the impulse responses of total, conventional and Islamic credit changes to interest rate shocks, obtained respectively from models 1, 2 and 3. It can be seen that the dynamic responses of the credit market to monetary policy shocks change as the economy shifts from one phase of the business cycle to another. Specifically, a positive interest rate shock generally leads to a decline in conventional and Islamic credit, especially when the economy operates in the low growth regime. Moreover, Islamic credit appears to be less responsive than conventional credit to the interest rate shock in both growth regimes; also, the response of the former (latter) credit is negligible in the higher growth regime.

Fig. 7 shows the responses of each type of credit to a negative money supply shock. It is evident that both react, with the initial effect in both cases being negative in the lower regime; also, it takes one (two) month(s) for the response of conventional (Islamic) credit to settle down. In the higher regime, the initial effect of the shock on conventional (Islamic) credit is negative (positive), and becomes weaker within the first month.[14]

5.4. Responses of GDP growth and inflation to credit shocks

Figs. 8 and 9 display the effects of a tightening in total, conventional and Islamic credit respectively on output growth and inflation based on the estimated linear and TVAR models. In general, the effects on both output growth and inflation are negative, except for the effect of Islamic credit on growth in the low regime which is positive in the first month and then becomes negative in the following few months. Further, the effects on inflation are higher in the low than in the high growth regime. Intuitively, a negative credit shock has more adverse effect on aggregate demand and hence on the price level when the economy is operating below full capacity (the low growth phase) than when the economy is overheating (the high growth phase) (Avdjiev & Zeng, 2014).

Comparatively Islamic credit shocks have a lower impact than conventional credit ones on both output growth and inflation in both regimes; the impact of both credits is relatively stronger in the lower than in the high regime. Possible explanations for these findings are the lower share of Islamic banking in the financial system of Malaysia, the principles of Islamic finance not allowing Islamic banks to engage in speculative or prohibited activities, and the underdevelopment of the Islamic money market (Khatat, 2016).

5.5. Variance decomposition (VD) analysis

We also carry out Variance Decomposition (VD) analysis to capture the dynamic effect of a shock to endogenous variables over a forecast horizon of 15 months. The forecast error variance decomposition analysis from the linear and TVAR models (see Tables 6 and 7) corroborates the findings of the linear and threshold impulse responses by highlighting clear differences between the low and high growth regimes.

Tables 6 and 7 report the VD respectively for inflation and output growth (from models 1, 2, and 3). Both the linear and threshold results imply that most of the forecast error variance of inflation is explained by its own shocks. The linear model seems to underestimate the contribution of credit changes, which appears to be much higher in the nonlinear models (especially in the lower regime). More specifically, conventional credit changes explain more of the variations in inflation, especially in the low growth

[12] The "price puzzle" concerns an increase in the price level following a contractionary monetary shock (Bernanke & Blinder, 1992; Sims, 1992). Recent papers on the "price puzzle" include Castelnuovo and Surico (2010) and Çatık and Martin (2012), among others.

[13] The results of the effects of positive interest rate and negative money supply shocks on output growth and inflation obtained from models 2 and 3 were qualitatively the same and are available upon request.

[14] To gain further insights into these findings, we obtained additional VAR estimates for the response of credit over the different sub-samples covering the period before and after 2002 since Islamic credit was marginal and < 7% of total credit before 2002. Sub-sample estimation was also carried out over the period before and after 2004 because the Central Bank of Malaysia has used the overnight interest rate as a policy rate since April 2004. These sub-sample results are shown in Figs. A2 to A5 in the Appendix A and imply that Islamic credit became more sensitive to changes in the interest rate in the post-2002 and 2004 periods, with an increase in the Islamic share credit since then.

regime, than Islamic credit changes that seem to play a relatively minor role (slightly greater in the high growth regime). For instance, in the low growth regime, over a 15-month horizon, conventional credit changes account for 8.4% of the total variation in inflation as opposed to 1.792% in the case of Islamic credit changes. This finding might reflect the distinctive features of Islamic credit, which only funds transactions related to a tangible underlying asset rather than speculative activities, hence affecting inflation less (Adeola, 2007; Caporale & Helmi, 2018 and Kassim, 2016).

As for output growth (Table 7), it appears that in the high growth regime most of its variation is driven by conventional credit, followed by money supply and then Islamic credit. Instead in the low growth regime its variation is mostly explained by the interest rate, followed by inflation, and then both conventional and Islamic credits. Concerning the relative contribution of conventional versus Islamic credit, the former (7.949%) is higher than the latter (3.598%) over a 15-month forecast horizon in the high growth regime. However, in the low growth one their relative importance is reversed: Islamic and conventional credit changes account respectively for 12.209 and 4.631% of the variation over the same forecast horizon of 15 months. The sizeable contribution of Islamic credit changes to output growth in the low growth regime could be attributed to the Islamic banks' business model and business ethics, which encourage investment, and hence enhance economic growth (Kassim, 2016). Specifically, the PLS paradigm and asset-based Islamic banking make these institutions less vulnerable and more stable during financial crises; for instance, the growth in assets and credit of Islamic banks continued to be higher than those of conventional banks during the recent financial crisis of 2007–08 in Saudi Arabia, Kuwait, Qatar, Bahrain, Jordan, Turkey and Malaysia (see Hasan & Dridi, 2010).

6. Conclusions

There is a growing debate on the different responses of monetary authorities to shocks during economic expansion (growth) and contraction (recession) phases and, therefore, the need to adopt a nonlinear econometric approach. This paper provides new insights by taking into account possible nonlinearities in the relationship between bank lending and monetary policy under different economic conditions in the Malaysian dual banking system during the period 1994:01-2015:06. Most previous related studies on dual banking systems use only a conventional VAR approach and ignore the recent development in the macroeconomics literature suggesting asymmetric responses to shocks by policymakers (see, e.g., Kassim et al., 2009; Sukmana & Kassim, 2010; Ergeç & Arslan, 2013; Aysan et al., 2017). Moreover, these empirical studies on Malaysia have not explored whether the reaction of both Islamic and conventional banks differs during economic expansion (growth) and contraction (recession) phases, even though Khalid et al. (2018) confirmed that using the Markov Switching Vector Autoregression model nonlinear framework is more appropriate to model the Taylor rule in Malaysia.

The present paper employs a two-regime TVAR model allowing for nonlinearities, hence offering a more reliable assessment of the bank lending channel in the Malaysian dual banking system over the different phases of the business cycle. Our TVAR model has several interesting features that make it particularly suitable for analysing the impact of monetary policy on bank lending behaviour in the case of Malaysia by allowing the responses to monetary policy shocks to depend upon the macroeconomic conditions.

Our main findings indicate that Islamic credit is less responsive than conventional credit to interest rate shocks in both the high and low growth regimes. However, the sub-sample estimates indicate that its response has increased in more recent years becoming quite similar to that of conventional credit. Moreover, our results confirm that the bank lending channel in Malaysia is state-dependent, differing in the low and high growth regimes; the (positive) effects of Islamic credit changes on output growth are more pronounced in the low growth regime.

These findings are broadly consistent with the existing evidence on the state-dependence of the transmission channels of monetary policy in developed economies. Moreover, they can be interpreted in terms of the distinctive features of Islamic banks, which operate according to the principles of Islamic finance, and therefore charge the ex-post PLS rate instead of conventional interest rates, and only finance projects directly linked to real economic activities (Berg & Kim, 2014). Given the evidence suggesting that Islamic credit boosts growth during low growth periods, policy-makers should take into account the Islamic bank lending channel in the design of monetary policy in economies with a dual (Islamic and conventional) banking system at such times. Policies aimed at improving the institutional structure and the efficiency of Islamic banks might also be appropriate, with a view to making the transmission of monetary policy more effective in countries such as Malaysia.

Appendix A

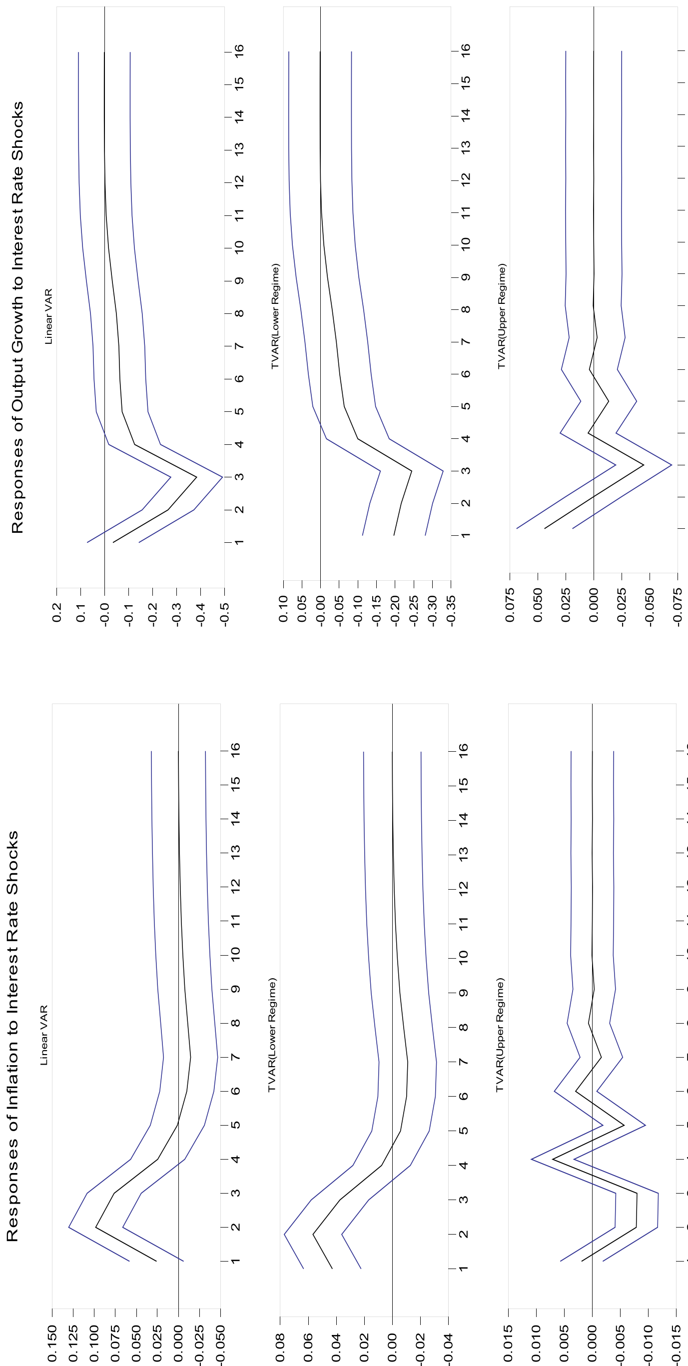

Fig. A1. Responses to interest rate shocks (Model with exogenous oil price change)
Note: The figures are obtained from model 1.

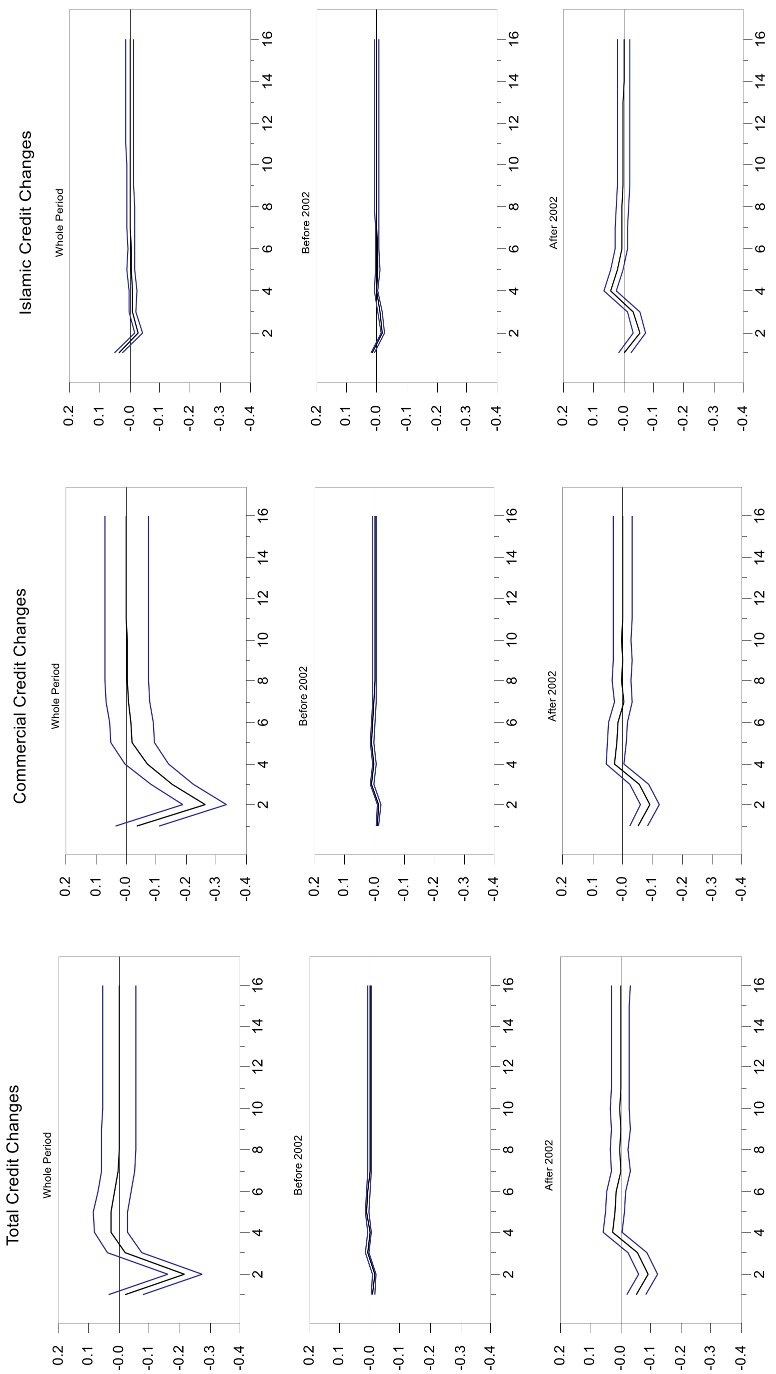

Fig. A2. Responses of credit changes to interest rate shocks (before and after 2002).

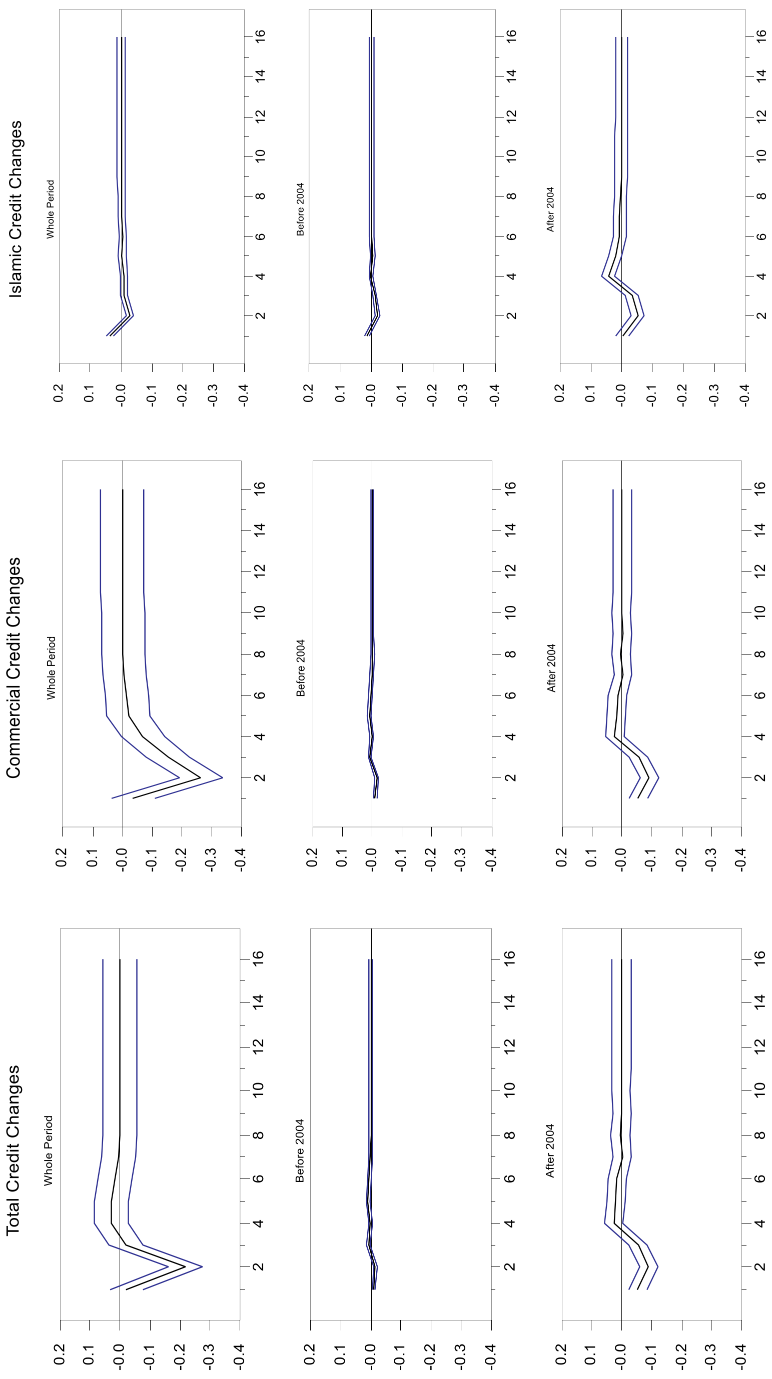

Fig. A3. Responses of credit changes to interest rate changes shocks (before and after 2004).

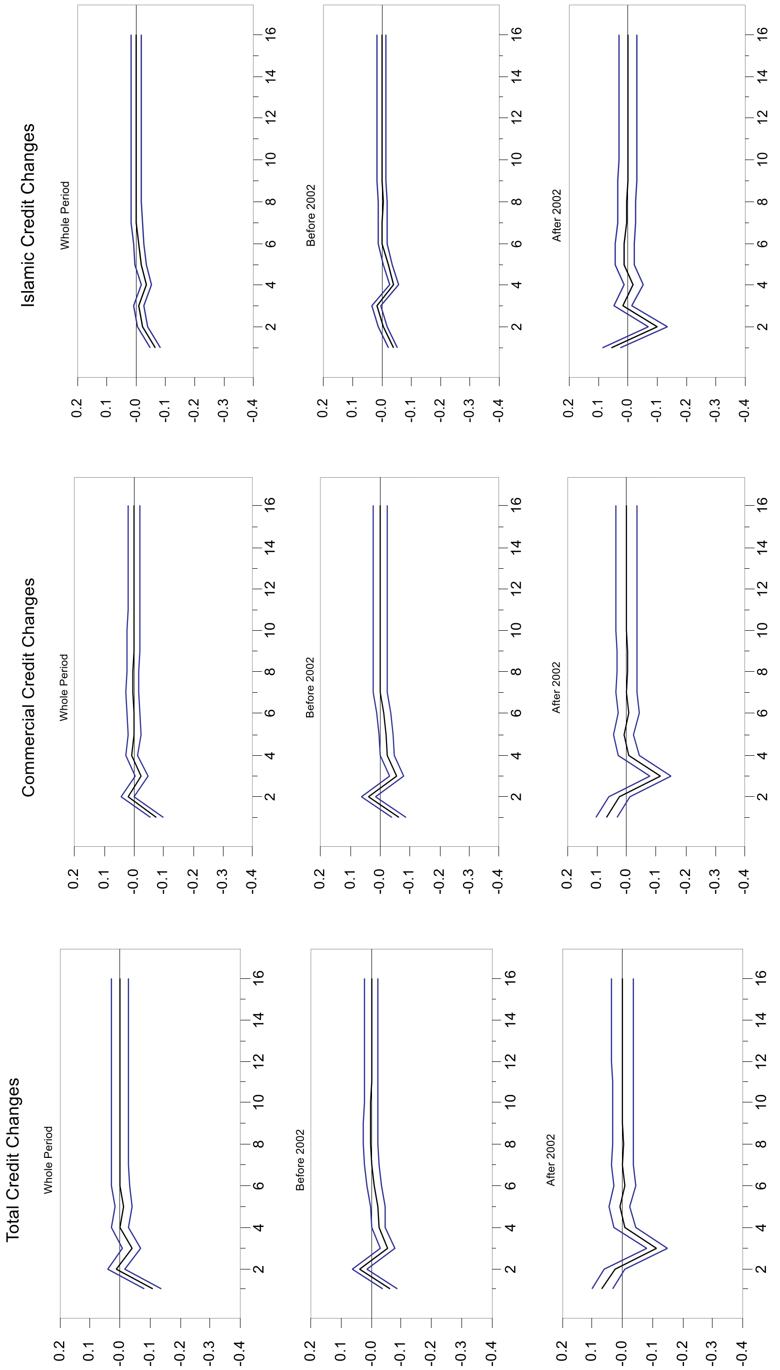

Fig. A4. Responses of credit changes to negative money supply shocks (before and after 2002).

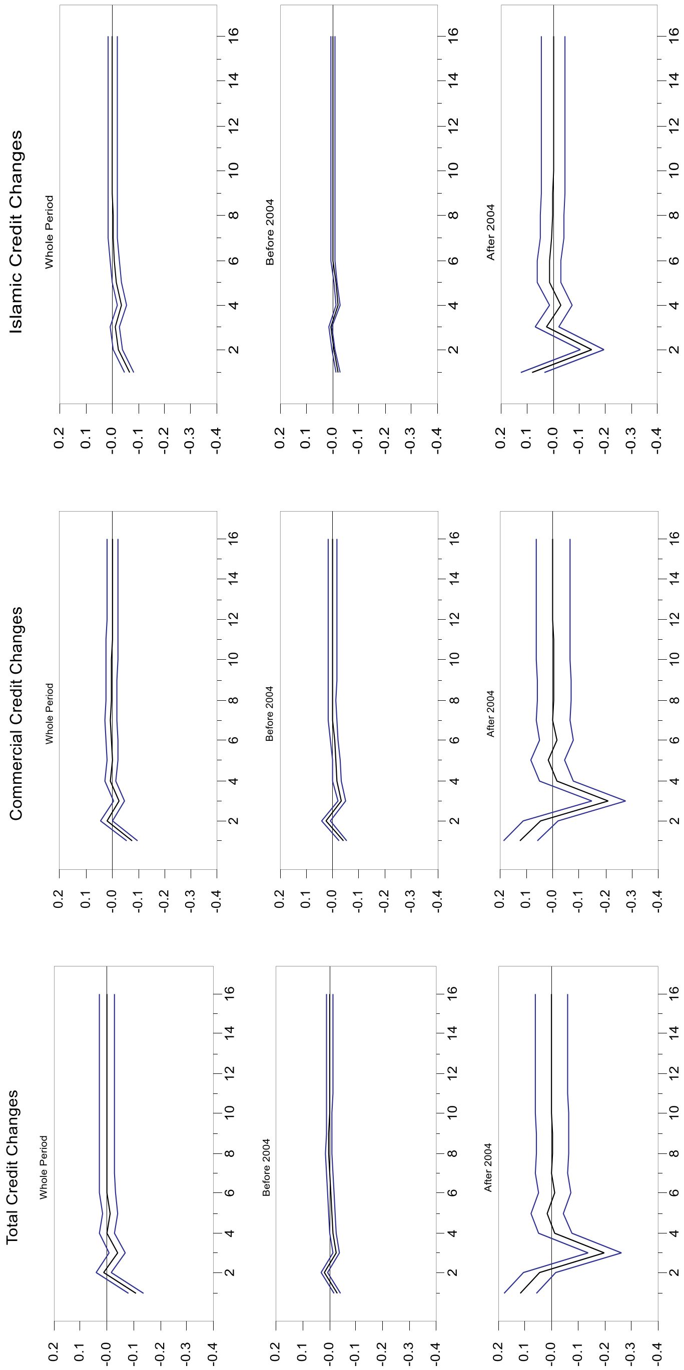

Fig. A5. Responses of credit changes to negative money supply shocks (before and after 2004).

References

Adeola, H. (2007). The role of Islamic banking in economic development in emerging markets. *A presentation at the Islamic forum business, Lagos*.
Akhatova, M., Zainal, M. P., & Ibrahim, M. H. (2016). Banking models and monetary transmission mechanisms in Malaysia: Are Islamic banks different? *Economic Papers: A Journal of applied economics and policy, 35*(2), 169–183.
Askari, H. (2012). Islamic finance, risk-sharing, and international financial stability. *Yale Journal of International Affair, 7*(1), 1–8.
Atanasova, C. (2003). Credit market imperfections and business cycle dynamics: A nonlinear approach. *Studies in Nonlinear Dynamics & Econometrics, 7*(4).
Avdjiev, S., & Zeng, Z. (2014). Credit growth, monetary policy and economic activity in a three-regime TVAR model. *Applied Economics, 46*(24), 2936–2951.
Aysan, A. F., Disli, M., Duygun, M., & Ozturk, H. (2018). Religiosity versus rationality: Depositor behavior in Islamic and conventional banks. *Journal of Comparative Economics, 46*(1), 1–19.
Aysan, A. F., Disli, M., & Ozturk, H. (2017). Bank lending channel in a dual banking system: Why are Islamic banks so responsive? *The World Economy, 41*(3), 674–698.
Baele, L., Farooq, M., & Ongena, S. (2014). Of religion and redemption: Evidence from default on Islamic loans. *Journal of Banking & Finance, 44*, 141–159.
Baldwin, K., Alhalboni, M., & Helmi, M. H. (2018). A structural model of "alpha" for the capital adequacy ratios of Islamic banks. *Journal of International Financial Markets, Institutions and Money*. https://doi.org/10.1016/j.intfin.2018.12.015 In Press, Accepted Manuscript.
Balke, N. S. (2000). Credit and economic activity: Credit regimes and nonlinear propagation of shocks. *Review of Economics and Statistics, 82*(2), 344–349.
Beck, T., Demirgüç-Kunt, A., & Merrouche, O. (2013). Islamic vs. conventional banking: Business model, efficiency and stability. *Journal of Banking & Finance, 37*(2), 433–447.
Berg, N., & Kim, J. (2014). Prohibition of Riba and Gharar: A signaling and screening explanation? *Journal of Economic Behavior & Organization, 103*, S146–S159.
Bernanke, B., & Blinder, A. (1992). The Federal funds rate and the channels of monetary transmission. *The American Economic Review, 82*, 901–921.
Bernanke, B. S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives, 9*(4), 27–48.
BNM (2006). *Bank Negara Malaysia Annual Report 2005*. Kuala Lumpur: Bank Negara Malaysia. March. Available at: http://www.bnm.gov.my/files/publication/ar/en/2005/ar2005_book.pdf.
BNM (2012). *Bank Negara Malaysia Annual Report 2011*. Kuala Lumpur: Bank Negara Malaysia. March. Available at: http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_bnmar&ac=89&yr=2011.
BNM. (2015) 'Bank Negara Malaysia Annual Report 2014', Kuala Lumpur: Bank Negara Malaysia, March. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_bnmar&eId=box2&lang=en&yr=2014
Boivin, J., Kiley, M. T., & Mishkin, F. S. (2010). How has the monetary transmission mechanism evolved over time? *Handbook of monetary economics* (pp. 369–422). 3(C).
Caporale, G. M., & Helmi, M. H. (2018). Islamic banking, credit, and economic growth: Some empirical evidence. *International Journal of Finance & Economics, 23*(4), 456–477.
Caporale, G. M., Helmi, M. H., Çatık, A. N., Menla Ali, F., & Akdeniz, C. (2018). Monetary policy rules in emerging countries: Is there an augmented nonlinear Taylor rule? *Economic Modelling, 72*, 306–319.
Castelnuovo, E., & Surico, P. (2010). Monetary policy, inflation expectations and the price puzzle. *The Economic Journal, 120*, 1262–1283.
Castro, V. (2011). Can central banks' monetary policy be described by a linear (augmented) Taylor rule or by a nonlinear rule? *Journal of Financial Stability, 7*(4), 228–246.
Çatık, A. N., & Karaçuka, M. (2012). The Bank Lending Channel in Turkey: Has it changed after the low inflation regime? *Applied Economics Letters, 19*, 1237–1242.
Çatık, A. N., & Martin, C. (2012). Macroeconomic transitions and the transmission mechanism: Evidence from Turkey. *Economic Modelling, 29*(4), 1440–1449.
Chakravarty, S. R., & Pal, R. (2013). Financial inclusion in India: An axiomatic approach. *Journal of Policy Modelling, 35*(5), 813–837.
Chong, B. S., & Liu, M. (2009). Islamic banking: Interest-free or interest-based? *Pacific-Basin Finance Journal, 17*(1), 125–144.
Daher, H., Masih, M., & Ibrahim, M. (2015). The unique risk exposures of Islamic banks' capital buffers: A dynamic panel data analysis. *Journal of International Financial Markets, Institutions and Money, 36*, 36–52.
Di Mauro, F., Caristi, P., Couderc, S., Di Maria, A., Ho, L., Kaur Grewal, B., ... Zaheer, S. (2013). Islamic finance in Europe. *Occasional paper series no. 146*. European Central Bank.
Ergeç, E. H., & Arslan, B. G. (2013). Impact of interest rates on Islamic and conventional banks: The case of Turkey. *Applied Economics, 45*(17), 2381–2388.
Ernst and Young (2014). *World Islamic Bank in Competitiveness 2013–2014 UK*. Ernst & Young Global Limited.
Ernst and Young (2016). *World Islamic Bank in Competitiveness 2016 UK*. Ernst & Young Global Limited.
Garcia, R., & Schaller, H. (2002). Are the effects of monetary policy asymmetric? *Economic Inquiry, 40*(1), 102–119.
Ghassan, H., Fachin, S., & Guendouz, A. (2013). *'Financial stability of Islamic and conventional banks in Saudi Arabia: A time series Analysis' (no. 2013/1)*. Centre for Empirical Economics and Econometrics, Department of Statistics," Sapienza" University of Rome.
Gordon, D. B., & Leeper, E. M. (1994). The dynamic impacts of monetary policy: An exercise in tentative identification. *Journal of Political Economy, 102*(6), 1228–1247.
Hamza, H., & Saadaoui, Z. (2018). Monetary transmission through the debt financing channel of Islamic banks: Does PSIA play a role? *Research in International Business and Finance, 45*, 557–570.
Hanson, M. S. (2004). The "price puzzle" reconsidered. *Journal of Monetary Economics, 51*, 1385–1413.
Hasan, M., & Dridi, J. (2010). The effects of the global crisis on Islamic and conventional banks: A comparative study. *IMF working paper WP/10/201*.
Ibrahim, M. H., & Alam, N. (2017). Islamic economics and Islamic finance in the world economy. *The World Economy*. https://doi.org/10.1111/twec.12506.
Iqbal, Z., & Mirakhor, A. (2013). *Economic development and Islamic finance*. Washington, D.C: The World Bank Group.
Kammer, M. A., Norat, M. M., Pinon, M. M., Prasad, A., Towe, M. C. M., & Zeidane, M. Z. (2015). Islamic finance: Opportunities, challenges, and policy options. *IMF Staff Papers, 15*(5), 1–38.
Kashyap, A. K., & Stein, J. C. (1995). The impact of monetary policy on bank balance sheets. *Carnegie Rochester Conference Series on Public Policy, 42*, 151–195.
Kassim, S. (2016). Islamic finance and economic growth: The Malaysian experience. *Global Finance Journal, 30*, 66–76.
Kassim, S. H., Majid, M. S. A., & Yusof, R. M. (2009). Impact of monetary policy shocks on the conventional and Islamic banks in a dual banking system: Evidence from Malaysia. *Journal of Economic Cooperation and Development, 30*(1), 41–58.
Khalid, N., Ahmad, M. A. S., & Hamidi, H. N. A. (2018). Nonlinear monetary policy reaction function in Malaysia: Evidence using a Markov switching vector autoregression. *International Journal of Economics and Management, 12*(1), 189–203.
Khan, M. S., & Mirakhor, A. (1989). The financial system and monetary policy in an Islamic economy. *Islamic Economics, 1*(1), 39–58.
Khatat, M. E. (2016). Monetary policy in the presence of Islamic banking. *IMF working paper WP/16/72*.
Kim, D. W., Yu, J. S., & Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance, 43*, 1–14.
Lee, J., & Strazicich, M. C. (2003). Minimum Lagrange multiplier unit root test with two structural breaks. *Review of Economics and Statistics, 85*(4), 1082–1089.
Lucas, R. E. (2014). Liquidity: Meaning, measurement, management. *Federal Reserve Bank of St. Louis Review, 96*(3), 199–212.
McCauley, R. N. (2006). Understanding monetary policy in Malaysia and Thailand: Objectives, instruments and independence. *BIS papers no 31* (pp. 172–198). .
Mishkin, F. S. (1995a). Symposium on the monetary transmission mechanism. *The Journal of Economic Perspectives, 9*(4), 3–10.
Mishkin, F. S. (1995b). The dangers of exchange-rate pegging in emerging market countries. *International Finance, 1*(1), 81–101.
Mishkin, F. S. (2001). The transmission mechanism and the role of asset prices in monetary policy. *NBER working no 8617*.
Mishra, P., Montiel, P. J., & Spilimbergo, A. (2012). Monetary transmission in low-income countries: Effectiveness and policy implications. *IMF Economic Review, 60*(2), 270–302.
Pacicco, F., Vena, L., & Venegoni, A. (2019). Market reactions to ECB policy innovations: A cross-country analysis. *Journal of International Money and Finance, 91*, 126–137.
Peersman, G., & Smets, F. (2002). Are the effects of monetary policy in the euro area greater in recessions than in booms? *Monetary transmission in diverse economies* (pp. 28–48). .
Peersman, G., & Smets, F. (2003). The monetary transmission mechanism in the euro area: Evidence from VAR analysis. In I. Angeloni, A. Kashyap, & B. Mojon (Eds.). *Monetary policy transmission in the euro area* (pp. 36–55). Cambridge, UK: Cambridge University Press.
Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346.
Sims, C. A. (1980). Macroeconomics and reality. *Econometrica, 48*(1), 1–48.
Sims, C. A. (1992). Interpreting the macroeconomic time series facts: The effects of monetary policy. *European Economic Review, 36*, 2–16.
Sukmana, R., & Kassim, S. H. (2010). Roles of the Islamic banks in the monetary transmission process in Malaysia. *International Journal of Islamic and Middle Eastern Finance and Management, 3*(1), 7–19.
Tsay, R. S. (1989). Testing and modeling threshold autoregressive processes. *Journal of the American Statistical Association, 84*(405), 231–240.
Tsay, R. S. (1998). Testing and modeling multivariate threshold models. *Journal of the American Statistical Association, 93*(443), 1188–1202.